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National Dioxin Study Tier 4 Combustion Sources: Final Test Report Site 7, Wood Fired Boiler WFB-A

Radian Corp., Research Triangle Park, NC

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National Dioxin Study Tier 4 — Combustion Sources

Final Test Report — Site 7 Wood Fired Boiler WFB — A

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16. ABSTRACT

This report summarizes the results of a dioxin/furan emissions test of a wood-fired boiler equipped with a fabric filter system for particulate emissions control. The boiler combusts a combination of bark, hogged wood, sawdust, and green and dry planer shavings. This test is the seventh in a series of emission tests conducted under Tier 4 of the National Dioxin Study. The primary objective of tier 4 is to determine if various combustion devices are sources of dioxin and/or furan emissions. If any of the combustion sources are found to emit dioxin or furan, the secondary ojective of Tier 4 is to quantify these emissions.

Wood-fired boilers are one of eight combustion device categories that have been tested in the Tier 4 program. The tested boiler, hereafter referred to as Boiler WFB-A, was selected for this test after an initial information screening and a 1-day pretest survey. The logs which are processed at the plant are stored in a salt water body adjacent to the plant. Thus, the feed to Boiler WFB-A has a higher inorganic chloride content than the feed to most wood-fired boilers. Boiler WFB-A is considered representative of those wood-fired boilers in the United States firing salt-laden wood.

Data presented in the report include dioxin (tetra through octa homologue +2378 TCDD) and furan (tetra through octa homologue +2378 TCDF) results for both stack samples and ash samples. In addition, process data collected during sampling are also presented.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Emissions Combustion Sources Dioxin Furans 2,3,7,8 Tetrachlorodibenzo-p-dioxin Wood-Fired Boiler Dis.	Air Pollution Emissions Data	

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NATIONAL DIOXIN STUDY
TIER 4 — COMBUSTION SOURCES

Final Test Report — Site 7
Wood Fired Boiler WFB — A

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April 1987

i.b

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FOREWORD

This report is the result of a cooperative effort between the Office of Research and Development's Hazardous Waste Engineering Research Laboratory (HWERL) and the Office of Air Quality Planning and Standard's Monitoring and Data Analysis Division (MDAD). The overall management of Tier 4 of the National Dioxin Study was the responsibility of MDAD. In addition, MDAD provided technical guidance for the source test covered by this report. HWERL was directly responsible for the management and technical direction of the source test.

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1.0 INTRODUCTION

This report summarizes the results of a dioxin/furan[a] emissions test of a wood-fired boiler equipped with a fabric filter system for particulate emissions control. The boiler combusts a combination of bark, hogged wood, sawdust, and green and dry planer shavings. This test is the seventh in a series of emission tests conducted under Tier 4 of the National Dioxin Study. The primary objective of Tier 4 is to determine if various combustion devices are sources of dioxin and/or furan emissions. If any of the combustion sources are found to emit dioxin or furan, the secondary objective of Tier 4 is to quantify these emissions.

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This test report is organized as follows. A summary of test results and conclusions is provided in Section 2.0, followed by a detailed process description in Section 3.0. The source sampling and analysis plan is outlined in Section 4.0 and the field sampling and analytical data are presented in Section 5.0. Sections 6.0 through 9.0 present various testing details. These include descriptions of the sampling locations and procedures (Section 6.0), descriptions of the analytical procedures (Section 7.0), and a summary of the quality assurance/quality control results (Section 8.0). The appendices contain data generated during the field sampling and analytical activities.

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[a] The term "dioxin/furan" as used in this report refers to the polychlorinated dibenzo-p-dioxin and dibenzofuran isomers with four or more chlorine atoms.

2.0 SUMMARY AND CONCLUSIONS

2.1 SOURCE SAMPLING AND ANALYSIS OVERVIEW

The host site (Site WFB-A) is a lumber products plant that uses a wood-fired boiler system to generate process steam. The boiler is fired with a mixture of bark, hogged wood, sawdust, and green and dry planer shavings. Particulate emissions in the exhaust gases from the boiler are controlled by a fabric filter system. A schematic flow diagram of the wood-fired boiler system is presented in Figure 2-1.

The gaseous, liquid and solid sampling conducted in this test program are summarized in Table 2-1. Sampling for dioxin/furan emissions was performed at the inlet to and the outlet from the fabric filter (baghouse) during each of three test runs conducted on April 16, 17, and 18, 1985. The dioxin/furan sampling procedure was based on the October 1984 draft of the Modified Method 5 (MM5) procedure developed by the American Society of Mechanical Engineers (ASME) for measuring emissions of chlorinated organic compounds. Minor changes were made to the ASME protocol as a result of earlier Tier 4 tests. The changes are described in Section 6 of this report. The MM5 sample train components (probe rinses, filter, sorbent trap, etc.) were analyzed for dioxins/furans by ECL-BSL and EMSL-RTP, two of three EPA laboratories referred to collectively in the National Dioxin Study as Troika. The analyses quantified the isomer 2378-tetrachlorodibenzo-p-dioxin (2378-TCDD), the tetra- through octa- polychlorinated dioxin homologues (PCDD), and the tetra- through octa- polychlorinated dibenzofuran homologues (PCDF).

Dioxin/furan and precursor analyses were performed on a composite sample of the wood fuel. Samples of the baghouse dust and the boiler bottom ash were collected for dioxin/furan analysis. The dioxin/furan analyses were performed by Troika and the precursor analyses were performed by Radian. Specific precursors analyzed for were chlorophenols, chlorobenzenes,

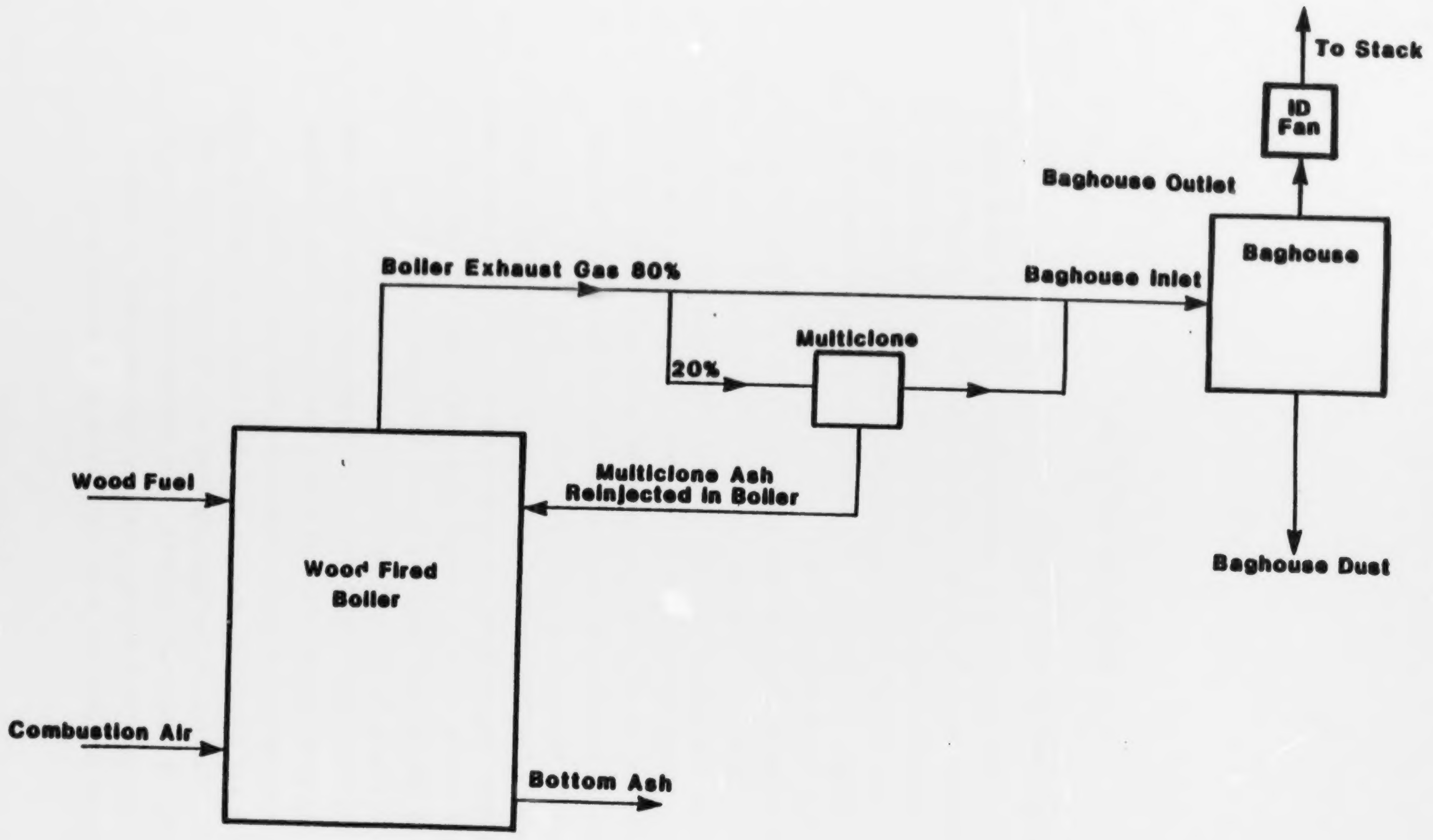

To Stack
ID Fan
Baghouse Outlet
Baghouse
Boiler Exhaust Gas 80%
Baghouse Inlet
Multiclone
20%
Wood Fuel
Multiclone Ash Reinjected in Boiler
Wood Fired Boiler
Baghouse Dust
Combustion Air
Bottom Ash

Figure 2-1. Schematic Process Flow Diagram for Site WFB-A.

TABLE 2-1. SOURCE SAMPLING AND ANALYSIS OVERVIEW

Item	Item Description
1. Number of test runs	- Three identical test runs (Runs 01, 02, 03)
2. Gaseous Sampling	- MM5 dioxin sampling at the baghouse outlet and baghouse inlet (boiler outlet). (Runs 01, 02, 03) Dioxin/furan analysis.
	- HCl sampling at the baghouse outlet (Runs 01, 02, 03). HCl analysis.
	- EPA Reference Methods 2 and 4 at baghouse outlet and baghouse inlet (boiler outlet) (Runs 01, 02, 03). Gas velocity and moisture.
	- Integrated bag sampling (EPA Reference Method 3) at the baghouse outlet and baghouse inlet (boiler outlet) (Runs 01, 02, 03) CO_2, O_2, and N_2 analysis for molecular weight determination.
	- Continuous monitoring of CO, CO_2, O_2, NO_x, and THC (total hydrocarbon) at baghouse inlet (boiler outlet) (Runs 01, 02, 03)
3. Solids Sampling	- Wood fuel sampling (Runs 01, 02, 03). Dioxin precursor analysis and total chloride analysis.
	- Baghouse dust sampling (Runs 01, 02, 03) Dioxin/furan analysis, bioassay.
	- Boiler bottom ash sampling (Runs 01, 02, 03) Dioxin/furan analysis, bioassay.
	- Soil sampling (one composite sample from 10 locations). Potential dioxin/furan analysis.

polychlorinated biphenyls, and total chlorine. The baghouse dust and boiler bottom ash were also collected for bioassay testing performed by EPA/ERL-Duluth.

Continuous emission monitors were operated during the test periods to measure CO_2, O_2, CO, NO_x, and total hydrocarbon (THC) concentrations at the boiler outlet. The continuous emission monitor (CEM) data are used in conjunction with the process data to document the stability of combustion conditions during the test.

A single composite soil sample was collected under Tier 4 and was transferred to Tier 7 for potential dioxin/furan analysis.

2.2 SUMMARY OF RESULTS

The data obtained at Site WFB-A during the Tier 4 test program are summarized in Figure 2-2. Detectable quantities of all targeted dioxin and furan species were found in the stack gas at the outlet from the baghouse. As shown in Table 2-2, average as-measured stack of gas concentrations of 2378-TCDD, total PCDD, and total PCDF at the baghouse outlet were 0.08 ng/dscm, 58 ng/dscm, and 25 ng/dscm, respectively. The hourly emission rates at the baghouse outlet were 5.8 ug/hour for 2378-TCDD, 4190 ug/hour for total PCDD, and 1800 ug/hour for total PCDF. The baghouse appeared to have positive control for furans but exhibited negative control for the dioxins, although analytical uncertainties inherent in GC/MS analysis limit the ability to quantify the control efficiency accurately. The dioxins were fairly evenly distributed among the tetra through octa-chlorinated dioxin homologues. The tetra-chlorinated furan homologue was the largest single contributor to the total PCDF emissions.

At the baghouse inlet, detectable quantities of 2378-TCDD, total PCDD, and total PCDF were found. Average as-measured stack gas concentration of 2378-TCDD, total PCDD, and total PCDF at the baghouse intlet were 0.35 ng/dscm, 37 ng/dscm, and 62 ng/dscm, respectively. The hourly emission rates at the baghouse inlet were 16 ug/hour for 2378-TCDD, 2640 ug/hour for total PCDD, and 4380 ug/hour for total PCDF. The dioxins were fairly evenly

Flue Gas Parameter Data Ⓐ
Baghouse Outlet

Flow Rate: 1208.4 dscmm
Temperature: 224.0°C
Moisture: 10.8% vol

Baghouse Inlet Dioxin/Furan Emission Data Ⓑ

Species	Concentration[a,b] (ng/dscm)	Emission Rate[b] (ug/hr)	Emission Factor[b] (ug/kg)
2378-TCDD	0.35[c]	16.0	4.07E-03
Total PCDD	37.2	2637.0	0.491
Total PCDF	61.9	4380.0	0.752

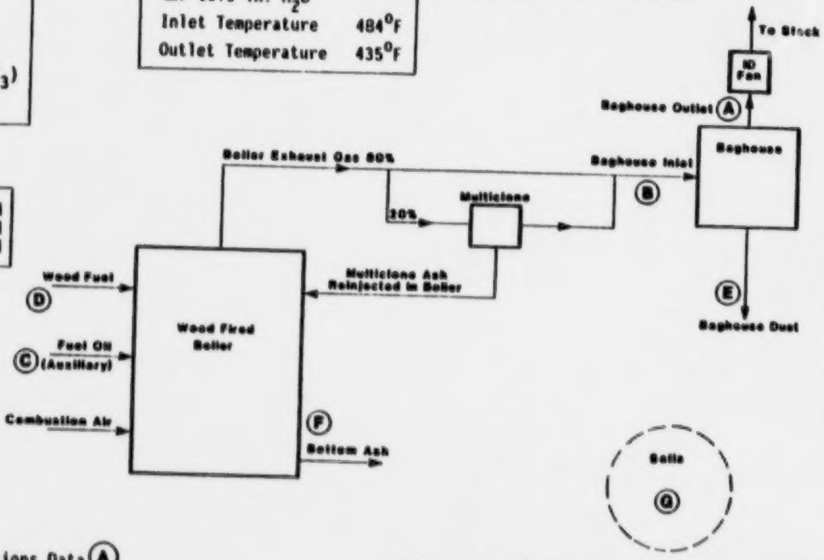
[a] as-measured concentration
[b] average of three test runs
[c] average of two test runs

Baghouse Inlet
Continuous Monitoring Data Ⓑ

O_2	13.0% vol
CO_2	17.9% vol
CO	272.7 ppmv
THC	1.9 ppmv (C_3)
NO_x	0.27 ppmv

Baghouse Operating Data

ΔP 13.5 in. H_2O
Inlet Temperature 484°F
Outlet Temperature 435°F


To Stack
ID Fan
Baghouse Outlet Ⓐ
Baghouse
Boiler Exhaust Gas 80%
Baghouse Inlet
Ⓑ
20%
Multiclone
Wood Fuel
Ⓓ
Multiclone Ash Reinjected in Boiler
Ⓔ
Baghouse Dust
Wood Fired Boiler
Fuel Oil
Ⓒ (Auxiliary)
Combustion Air
Ⓕ
Bottom Ash
Soils
Ⓖ

Baghouse Dust
Dioxin/Furan Data Ⓔ

Species	Concentration (ng/g)[a]
2378-TCDD	1.0
Total PCDD	1143.5
Total PCDF	315.5

[a] average of three test runs

Feed Precursor Data Ⓓ

Chlorobenzenes	not detected
PCB's	not detected
Chlorophenols	not detected

Flue Gas Parameter Data Ⓑ
Baghouse Inlet

Flow Rate: 1188.4 dscmm
Temperature: 252.6°C
Moisture: 12.6% vol

Bottom Ash Dioxin/Furan Data Ⓕ

Species	Concentration (ng/g)[a]	
	Primary Chamber	Secondary Chamber
2378 TCDD	NR[b]	ND[c]
Total PCDD	0.15	0.01
Total PCDF	ND	ND

[a] average of three test runs
[b] not reported by Troika
[c] not detected

Chloride Emissions Data Ⓐ

Emissions Type	Concentration[ab] mg/dscm	Emission Rate[b] kg/hr
Front Half	17.31	1.14
Back Half	68.35	4.62
Train Total	85.66	5.76

[a] as-measured concentration
[b] average of three test runs

Baghouse Outlet Dioxin/Furan Emission Data Ⓐ

Species	Concentration[ab] (ng/dscm)	Emission Rate[b] (ug/hr)	Emission Factor[b] (ug/kg)
2378 TCDD	0.08	5.82	9.87E-04
Total PCDD	57.6	4193.3	0.711
Total PCDF	24.8	1801.3	0.306

[a] as-measured concentration
[b] average of three test runs

Figure 2-2. Data Summary for Site WFB-A

TABLE 2-2. SUMMARY OF MEAN DIOXIN AND FURAN EMISSIONS DATA FOR SITE WFB-A

Parameter	2378-TCDD	Total PCDD	Total PCDF
INLET:			
Emissions Concentration (ng/dscm)			
As-measured	0.35	37	62
Corrected to 3% O_2	0.87	102	156
Emissions Rate (ug/hr)	16.0	2640	4380
OUTLET:			
Emissions Concentration (ng/dscm)			
As-measured	0.08	58	25
Corrected to 3% O_2	0.28	195	83
Emissions Rate (ug/hr)	5.8	4190	1800

distributed among the tetra through octa-chlorinated dioxin homologues. The tetra-chlorinated furan homologue was the largest single contributor to the total PCDF emissions. Samples of bottom ash from the primary combustion chamber of the boiler contained 0.15 ng/g of total PCDD; no furans were detected in the primary combustion chamber bottom ash. Results were not reported for the 2378-TCDD isomer; however, the analyses indicate 2378-TCDD is a minor component of total TCDD's, if present. Samples of bottom ash from the secondary combustion chamber of the boiler contained an average of 0.01 ng/g of total PCDD. The 2378-TCDD isomer and PCDF homologues were not detected in the secondary combustion chamber bottom ash.

Samples of baghouse dust contained an average of 1.0 ng/g of 2378-TCDD, 1144 ng/g of total PCDD, and 316 ng/g of total PCDF including 5.6 ng/g of the 2378-TCDF isomer.

Chloride emissions at the baghouse outlet were measured at 86 ng/dscm which corresponds to 195 mg/dscm at 3 percent O_2. The average chloride emission rate was calculated to be 5.8 kg/hour.

Precursor analysis of the wood feed did not detect chlorobenzenes, polychlorinated biphenyls, or chlorophenols.

The baghouse treated an average of 1118.4 dscmm at a temperature of 253°C. At the outlet stack, the measured flow rate was 1208.4 dscmm at a temperature of 224°C. Average flue gas concentrations measured at the baghouse inlet by the Radian continuous emissions monitoring system were: O_2, 13 volume percent; CO_2, 17.9 volume percent at 3 percent O_2 (dry); CO, 272.7 ppmv at 3 percent O_2; THC, 1.9 ppmv at 3 percent O_2 (wet); and NO_x, 0.27 ppmv at 3 percent O_2 (dry).

The composite soil sample for Site WFB-A has not yet been analyzed for dioxin/furan content.

3.0 PROCESS DESCRIPTION

This section describes the host site and the wood-fired boiler/baghouse system tested. Data summarizing the operation of the boiler/baghouse system during the test periods are presented in Section 5.0.

3.1 HOST SITE DESCRIPTION

The host site (Site WFB-A) manufactures overlay panels and other lumber products. A total of seven wood-fired boilers supply steam to the plant.

The wood-fired boiler tested is a Babcock & Wilcox 3-cell Dutch-Oven boiler rated at 100,000 lb/hr high pressure (275 psig) steam. This boiler was built in 1939. Exhaust gases from the Babcock & Wilcox boiler are ducted to a Standard Havens baghouse. The Babcock & Wilcox boiler and Standard Havens baghouse are described in more detail in Section 3.2.

The remaining six wood-fired boilers at the plant are Dutch-Oven type Sterling boilers rated at 27,500 lb/hr low pressure steam each. These boilers were manufactured between 1924 and 1926. Exhaust gases from the Sterling boilers are ducted to a single baghouse that was recently destroyed by fire.

3.2 WOOD-FIRED BOILER DESCRIPTION

This section describes the Babcock & Wilcox boiler tested. For the purpose of the Tier 4 program, the boiler will be referred to as Boiler WFB-A.

3.2.1 Boiler Feed Materials

During normal operation, Boiler WFB-A is 100 percent fired with scrap wood mainly from the lumber plant at the host site. Some of the wood feed comes from other mills. The wood feed is a mixture of bark, hogged wood, and green and dry planer shavings. The composition of the wood feed as estimated in 1979 is 90 to 95 percent sawmill bark and 5 to 10 percent hogged wood.[1]

The wood type during the test was mainly Douglas fir. The scrap wood varies in size from sawdust to 3 inch diameter pieces and is well-mixed before entering the boiler.

Nearly all of the logs used at the lumber plant have been stored in a salt water body adjacent to the plant. Thus, the boiler feed is expected to have a considerably higher inorganic chloride content than the feed to most wood-fired boilers. Plant personnel indicate that the scrap wood has not been treated with the preservative pentachlorophenol.

In order to characterize the wood feed for each test day, wood feed samples were analyzed for heat content, moisture content, chlorine content, and carbon content. The results of the analyses are presented in Table 3-1. The analysis reports are contained in Appendix E. The heat content of the samples varied from 8,678 to 9,138 Btu/dry lb with a mean of 8,953 Btu/dry lb and a variation from the mean of 3 percent. The moisture content averaged 47.3 percent with a variation from the mean of 4 percent; the chlorine content averaged 30 percent and the carbon content averaged 54.2 percent. Overall, the characteristics of the wood fuel were similar for the three test runs.

An F-factor was calculated for the wood fuel. The F-factor ranged from 9,573 to 9,663 dscf/Btu. Typical F-factors for wood and wood bark are 9,280 dscf/Btu and 9,640 dscf/Btu, respectively.[2] Thus, the F-factors for the wood feed for the test period were typical.

A small amount of Bunker C oil is occasionally fired as auxiliary fuel in the boiler when the scrap wood is unusually wet, or when there is a malfunction in the wood feeding mechanism. However, no oil was fired during the testing periods.

3.2.2 Boiler Description

Boiler WFB-A is a Babcock & Wilcox 3-cell Dutch-Oven that was installed in 1939. The rated capacity of the boiler is 100,000 lb/hr of steam at 275 psig. A diagram of a one-cell Dutch-Oven is shown in Figure 3-1. Boiler WFB-A, which is a 3-cell, has three primary chambers which connect into a common secondary chamber.

TABLE 3-1. WOOD FEED CHARACTERISTICS

	Run 1	Run 2[1]	Run 3	Average
Heat content (Btu/dry lb)	9042	8678	9138	8953
Moisture content (wt %)	49.5	45.8	46.5	47.3
Chlorine content (wt %, dry)	0.33	0.30	0.26	0.30
Carbon content (wt %, dry)	54.2	53.8	54.5	54.2
F-factor (dscf/Btu)	9573	9663	9581	9606

[1] A duplicate sample was collected and analyzed for this run. These values are an average for the two samples. For the following parameters, the variations from the mean for the two samples were: heat content - 2 percent; chlorine content - 3 percent; and carbon content - 0.02 percent.

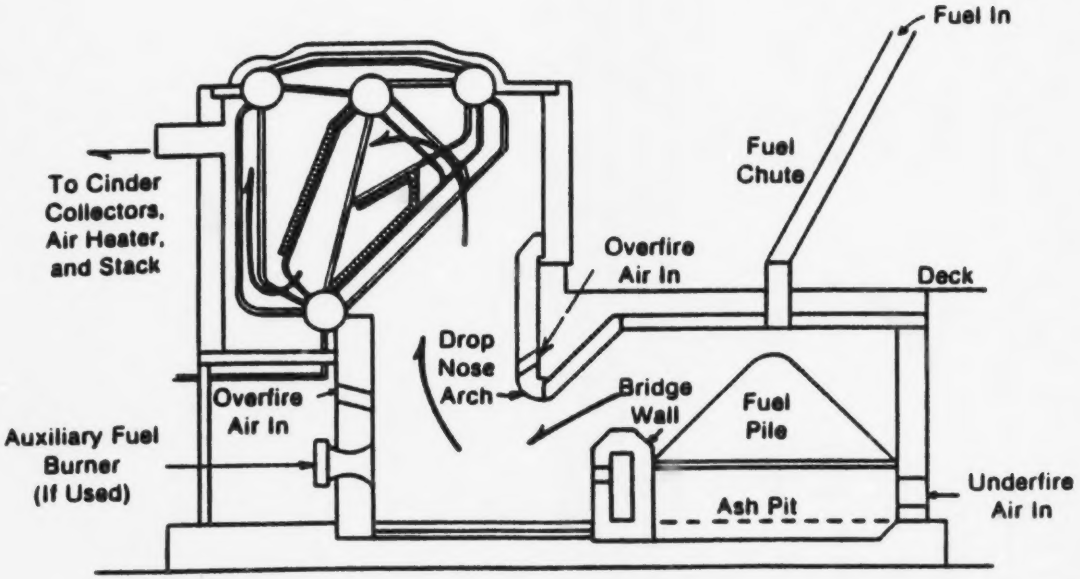

Fuel In
Fuel Chute
To Cinder Collectors, Air Heater, and Stack
Overfire Air In
Deck
Drop Nose Arch
Bridge Wall
Fuel Pile
Overfire Air In
Auxiliary Fuel Burner (If Used)
Underfire Air In
Ash Pit

Figure 3-1. One cell Dutch Oven - Type Boiler.[3]

Boiler WFB-A supplies high pressure steam to veneer dryers in the plywood plant. The normal steam requirement for the veneer dryers is about 38,000 lb/hr steam, so Boiler WFB-A is typically base loaded at about 40,000 lb/hr steam. To maintain steady operation of the boiler, excess steam is routed to a pressure reducer for the low pressure steam system. The load of Boiler WFB-A fluctuates less than the other six wood-fired boilers at the plant because variations in steam demand of the lumber plant are normally accommodated by the six smaller Sterling boilers.

The scrap wood is intermittently fed to the boiler by a screw conveyor that dumps the feed into a pile in the primary chamber. The feed rate is controlled by a temperature sensor that responds to the height of the pile. The temperature sensors are encased in a protective water jacket. The controller responds to the temperature of the water in the jacket. However, due to the age of the system, the boiler operators were unsure of the values of the setpoints.

Preheated combustion air enters the boiler as undergrate air in the primary chamber and through overfire air ports in the secondary chamber. During testing the boiler was operated at about 160 percent excess oxygen based on the continuous emission monitor (CEM) results.

The boiler is equipped with minimal process instrumentation. Data recorded on strip charts include steam flow, steam temperature, boiler outlet flue gas temperature, air heater outlet temperature, feedwater flowrate, feedwater temperature, and pressure. The boiler does not have an automatic oxygen trim system. The combustion air flowrates (draft) are controlled by forced draft and induced draft fan speeds. The combustion air flowrates are adjusted in conjunction with the steam pressure setpoint. An hourly data log is not maintained by the plant.

Ash is collected in ash pits for each primary chamber, and in the secondary chamber. The primary chamber ash pits are under positive pressure when the underfire air is flowing. The underfire air is preheated as it flows through the ash pits. The secondary chamber ash pit is under negative pressure. One ash pit is raked each night, including the secondary combustion chamber ash pit, if needed. Thus, each ash pit is raked about once a week. The exhaust gases from Boiler WFB-A pass to an emissions control system which is described in Section 3.3.

3.3 EMISSIONS CONTROL SYSTEM

Exhaust gases from Boiler WFB-A pass through an air preheater to a multi-cyclone/baghouse control system. The exhaust gases first pass through a cinder concentrator where an abrupt change in the gas stream direction and velocity impacts cinders onto pipes. A diagram of the cinder concentrator is shown in Figure 3-2. About 20 percent of the gas stream and the collected cinders are drawn through a multi-cyclone before returning to the main exhaust gas stream. The collected ash from the multi-cyclones is conveyed pneumatically from the multi-cyclones and reinjected into the Sterling boilers system. The pneumatic system could not be opened to collect multi-cyclone ash samples.

The exhaust gas stream then flows to a Standard-Havens six module baghouse. The baghouse treats about 100,000 acfm of exhaust gas at 480 to 500°F. The design air-to-cloth ratio of the baghouse is 4:1.

Each module has 196 teflon-coated glass fiber bags with an effective gas cleaning area of approximately 20 square feet per bag. The overall pressure drop across the baghouse controls the cleaning cycles. The setpoint of the controller ranges between 13 to 14.5 inches of water. If the cleaning cycle is not triggered after 20 minutes, then a cleaning cycle starts. However, during testing the pressure drop across the baghouse was always near or about the setpoint, so that the baghouse operates in a continuous cleaning mode. The collected dust from the baghouse is screw conveyed out to enclosed dumpsters. The temperature of the baghouse is also monitored to prevent high temperature damage to the bags.

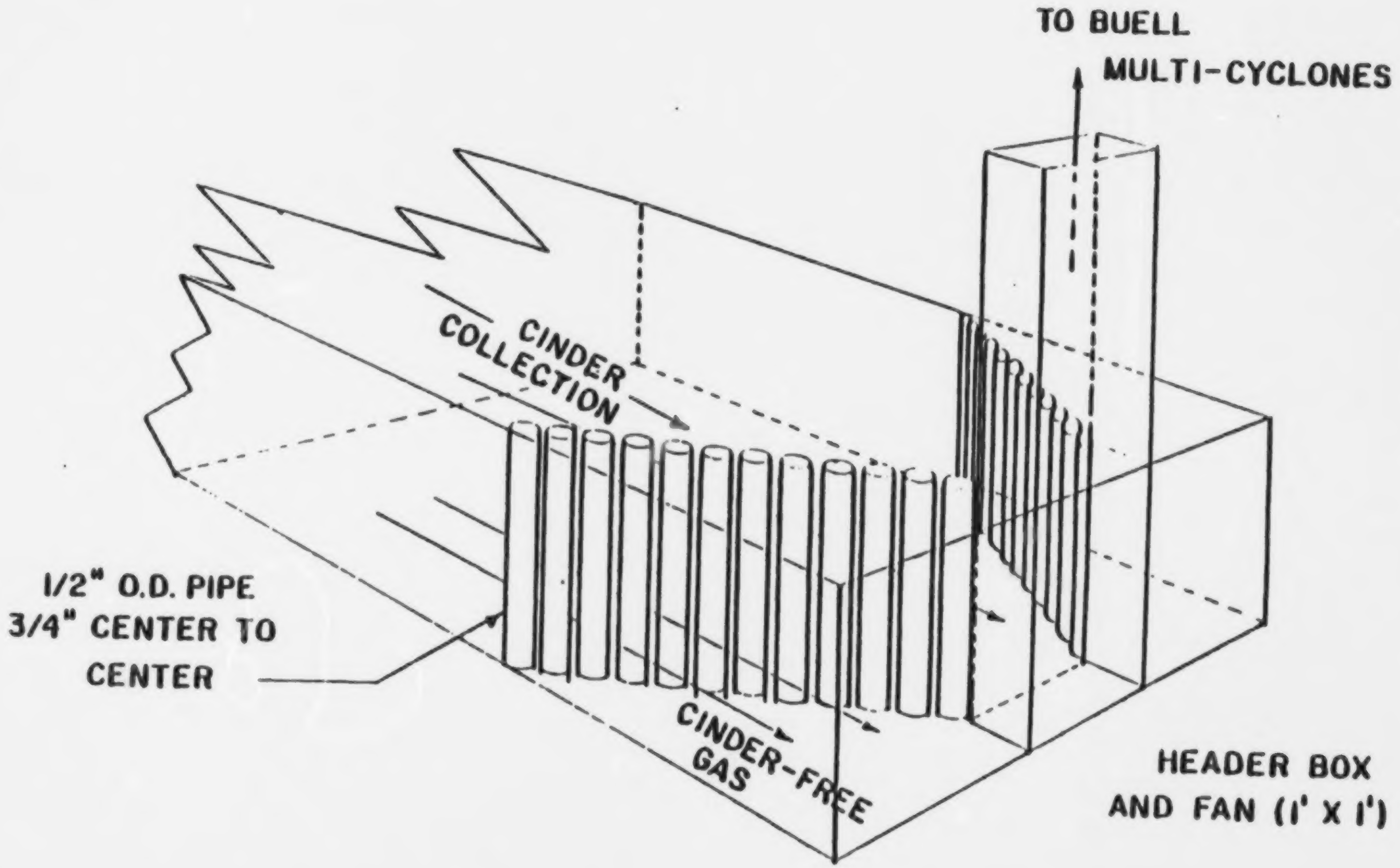

TO BUELL
MULTI-CYCLONES
CINDER
COLLECTION
1/2" O.D. PIPE
3/4" CENTER TO
CENTER
CINDER-FREE
GAS
HEADER BOX
AND FAN (1' X 1')

Figure 3-2. Cinder Concentrator Detail.

4.0 TEST DESCRIPTION

This section defines the field sampling, process monitoring, and analytical measurements that were performed at Site 07. The purpose of this section is to provide sufficient descriptive information about the test so that the test data presented in Section 5.0 can be easily understood. Specific testing details (specific sampling locations and procedures) are presented later in Section 6.0.

This section is divided into three parts. Section 4.1 summarizes field sampling activities, Section 4.2 summarizes process monitoring activities, and Section 4.3 summarizes analytical activities performed during the test program.

4.1 FIELD SAMPLING

Table 4-1 shows the source sampling and analysis matrix for Site 07. Three dioxin/furan emissions tests (Runs 01 - 03) were performed at the inlet and outlet to the baghouse. These sampling locations are shown as points A and B on Figure 4-1. Dioxin/furan sampling followed the Modified Method 5 (MM5) sampling protocol developed by the American Society of Mechanical Engineers (ASME) for measuring emissions of chlorinated organic compounds. During each test run, at least 240 minutes of on-line sampling were performed with the MM5 trains.

Concentrations of HCl in the flue gas were determined for each test day at the baghouse outlet exhaust stack using another modification of the EPA Method 5 (MM5/HCl). Continuous emission monitoring (CEM) of O_2, CO, CO_2, NO_x, and total hydrocarbons (THC) was performed at the baghouse inlet during each of the test runs.

Three types of process samples were taken during the MM5 test periods: wood feed samples, boiler bottom ash samples, and baghouse dust samples.

TABLE 4-1. SOURCE SAMPLING AND ANALYSIS MATRIX FOR SITE WFB-A

Sample Location Description	Location Identification^{a}	Sample Type	Number of Samples	Distribution of Samples^{b,c}	Analysis^{d,e}	Dioxin Analysis Priority^{f}
Gaseous Samples						
1. Baghouse Outlet	A	MM5 Dioxin	3 sets of 6	3 sets to Troika	Dioxin/furan	1
		MM5 Field Recovery Blank	1 set of 6	1 set to Troika	Dioxin/furan	1
		EPA Methods 2,4	3 sets	--	Flow, H_2O	-
		EPA Method 3	3 sets of 1	Field analysis	N_2, O_2, CO_2	-
		HCl Train	3 sets of 3	3 sets to Radian	HCl	-
		HCl Field Recovery Blank	1 set of 3	1 set to Radian	HCl	-
2. Baghouse Inlet (Boiler Outlet)	B	MM5 Dioxin	3 sets of 6	3 sets to Troika	Dioxin/furan	1
		MM5 Field Recovery Blank	1 set of 6	1 set to Troika	Dioxin/furan	1
		EPA Methods 2,4	3 sets	--	Flow, H_2O	-
		EPA Method 3	3 sets	Field analysis	N_2, O_2, CO_2	-
		Continuous Monitoring	3 sets	--	CO, CO_2, O_2, THC NO_x	-
3. Laboratory Blanks	-	MM5 Cleaning Blank	1 set of 3	1 set to Troika	Dioxin/furan	1
		MM5 Reagent Blanks	1 set of 3	1 set to Troika	Dioxin/furan	1
		HPLC Water, Acetone Methylene Chloride				
Solid Samples						
4. Wood Fuel	D	500 gm composite of hourly grab samples	4 sets of 3	1 set to Troika	Dioxin/furan	2
				1 set to Radian	Precursors	-
				1 set to Radian	Total chloride	-
				1 set to Radian	Moisture, heat content	-

TABLE 4-1. SOURCE SAMPLING AND ANALYSIS MATRIX FOR SITE WFB-A
(cont'd.)

Sample Location Description	Location Identification[a]	Sample Type	Number of Samples	Distribution of Samples[b,c]	Analysis[d,e]	Analysis Priority[f]
5. Baghouse Dust	E	500 gm composite of hourly grab samples	1 set of 3	1 set to Troika	Dioxin/furan	1
		100 gm composite of hourly grab samples	1 set of 3	1 set to Radian	Total chlorides	-
		5 lb composite (1/3 collected each test run)	1 set of 1	1 set to EPA/ERL-Duluth	Bioassay	-
6. Boiler Bottom Ash - Primary Chambers	F	500 gm sample of ash drawn daily	1 set of 3	1 set to Troika	Dioxin/furan	1
7. Boiler Bottom Ash - Secondary Chambers	F	500 gm sample of ash drawn daily	1 set of 3	1 set to Troika	Dioxin/furan	1
8. Boiler Bottom Ash - Composite	F	5 lb composite of all bottom ash (1/3 collected each test run)	1 set of 1	1 set to EPA/ERL-Duluth	Bioassay	-
9. Soils	G	500 gm composite of 10 gram samples	1 set of 1	1 set to Radian	Dioxin/furan	3

[a] Location identification as shown in Figure 4-1.

[b] Troika refers to the ERL-Duluth, ECL-Bay St. Louis, and EMSL-Research Triangle Park EPA laboratories as a collective unit.

[c] Radian refers to Radian's laboratory in Research Triangle Park, N.C.

[d] Dioxin means that 2,3,7,8-TCDD and tetra- through octa-dioxin/furan homologue analyses will be performed.

[e] Dioxin Precursors means that Cl-phenols, Cl-benzenes, PCB, and total chlorine analyses will be performed.

[f] Archive means that samples will be stored for possible future dioxin and/or dioxin precursor analyses.

[g] Dioxin analytical priorities are defined as follows:

Priority 1 - samples require immediate extraction and analysis.

Priority 2 - samples require immediate extraction if aqueous (designated "aq") but do not require immediate extraction if solid (designated "s"). All Priority 2 sample extracts and unextracted samples will be held for analysis pending the results of the Priority 1 analyses.

Priority 3 - samples will be archived for potential extraction and analysis pending the results of the Priority 2 analyses.

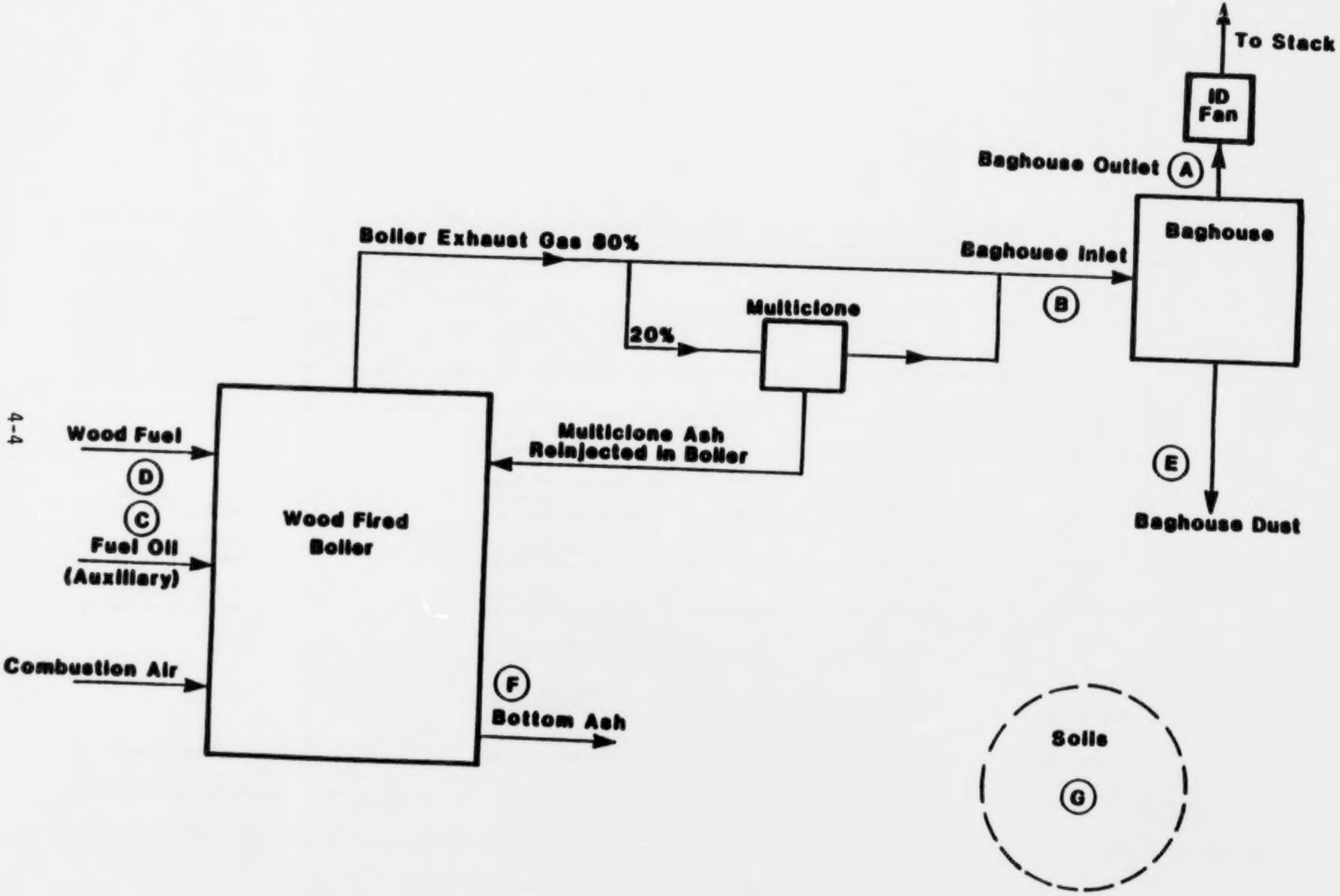

To Stack
ID Fan
Baghouse Outlet
A
Baghouse
Boiler Exhaust Gas 80%
Baghouse Inlet
B
Multiclone
20%
Multiclone Ash Reinjected in Boiler
E
Baghouse Dust
Wood Fuel
D
C
Fuel Oil (Auxiliary)
Wood Fired Boiler
Combustion Air
F
Bottom Ash
Soils
G

Figure 4-1. Sample Point Diagram for Site WFB-A.

Samples of the wood fuel and baghouse dust were taken each hour, and daily composite samples were prepared for each. Bottom ash samples were taken from the boiler after each test run. The primary chamber bottom ash pits were pressurized and could not be accessed while the boiler was operating.

Soil samples were collected from ten locations at the plant site. The ten samples were combined into a single composite, which is being held for potential dioxin/furan analysis pending evaluation of the MM5 dioxin/furan emissions data.

4.2 PROCESS DATA COLLECTION

Process data were collected to characterize the operation of the wood fired boiler and the baghouse during the MM5 test periods. Table 4-2 shows the type of data that was collected during the sampling.

4.3 LABORATORY ANALYSES

Laboratory analyses performed on samples from Site 07 included dioxin/furan analyses, dioxin/furan precursor analyses, and total chloride analyses. These analyses are discussed in Sections 4.3.1, 4.3.2, and 4.3.3, respectively.

4.3.1 Dioxin/Furan Analyses

All dioxin/furan analyses were performed by ECL-BSL and EMSL-RTP, two of three EPA laboratories collectively referred to as Troika.

Field samples requiring dioxin/furan analysis were prioritized based on their relative importance to the Tier 4 program objectives. The priority levels, in order of decreasing importance, were designated Priority 1 through Priority 3.

Priority 1 samples were sent to Troika with instructions to perform immediate extraction and analysis. These included the MM5 train components for the baghouse inlet and outlet sampling locations, MM5 field train blanks (one for each of the baghouse inlet and outlet), field solvent blanks, baghouse dust ash samples, and boiler bottom ash samples.

TABLE 4-2. PROCESS DATA COLLECTED DURING TESTING AT SITE WFB-A

Parameter	Source	Frequency
1. Furnace Operation		
• Feed Rate	Estimate from CO_2 emissions	Overall estimate for test period
For each cell:		
Primary chamber temperature	Thermocouple probe	Once per run
Pile temperature	Thermocouple probe	Once per run
Underfire air draft	Meter	Hourly
• secondary chamber temperature	Thermocouple probe	Once per run
• overfire air damper setting	Meter	Hourly
2. Boiler Operation		
• Steam rate	Chart record	Continuous
• Steam temperature	Chart record	Continuous
• Steam pressure	Chart record	Continuous
• Flue gas exit temperature	Chart record	Continuous
• Air heater exit temperature	Chart record	Continuous
• Feedwater temperature	Chart record	Continuous
• Feedwater flowrate	Chart record	Continuous
3. Fabric Filter Operation		
• Inlet temperature	Meter	Hourly
• ΔP across each module	Meter	Hourly
• Cleaning cycle time	Observation/ stopwatch	Once for test period

Priority 2 samples were sent to Radian/RTP for archiving. These samples may be analyzed for dioxin/furan in the future, pending the results of the Priority 1 analyses. Priority 2 samples at Site 07 include the wood feed samples.

The only Priority 3 sample taken was the composite soil sample. The soil sample was transferred to Tier 7 for potential dioxin/furan analysis.

4.3.2 Dioxin/Furan Precursor Analyses

Dioxin/furan precursor analyses of boiler feed samples were performed by Radian/RTP. The specific dioxin/furan precursors analyzed for included chlorophenols, chlorobenzenes, PCB's and total chlorine.

4.3.3 Total Chloride Analyses

Total chloride analyses were performed on front-half and back-half HCl train samples. Also analyzed for total chlorides were the baghouse dust and wood feed samples.

5.0 TEST RESULTS

The results of the Tier 4 dioxin/furan emission test of wood-fired boiler WFB-A are presented in this section. The individual test runs are designated as Runs 01-03.

Process data obtained during the test runs are presented in Section 5.1, and flue gas parameter data are presented in Section 5.2. Continuous monitoring results for O_2, CO, CO_2, NO_x, and THC concentrations at the baghouse inlet are presented in Section 5.3. The dioxin/furan emissions data for the MM5 sampling are contained in Section 5.4. Results of HCl train sampling at the baghouse outlet and chlorine analysis of the wood feed and baghouse dust samples are presented in Section 5.5. Dioxin/furan precursor analysis data for the wood feed samples and dioxin/furan analysis data for the baghouse catch and bottom ash samples are presented in Section 5.6.

5.1 PROCESS DATA

Process data were obtained to document Boiler WFB-A and baghouse operation during the test runs. In general, the process data indicate that process operations were stable during each of the three test runs. Also, the process data indicate that process operations were similar for each test run. Boiler operating data are summarized in Section 5.1.1, and baghouse operating data are summarized in Section 5.1.2.

5.1.1 Boiler WFB-A Operating Data

Since the wood fuel feed rate was not measured by the plant, and the design of the feed system was not conducive to a surrogate weighing system, the wood feed rate was estimated from the CO_2 emissions in the boiler flue gas. The wood fuel feed rate to the three primary chambers is estimated at 24,650 wet lb/hr wood feed using average process values of the 3-day test period.

The wood feed rate for each primary chamber is controlled by temperature sensors located in each of the three primary chamber piles. As the pile burns down, the temperature increases until the setpoint is reached and more feed is added. Combustion is temporarily dampened, and the pile temperature decreases until the recently added fuel begins to combust. The combustion zone temperatures were not measured by the plant, so a thermocouple was placed 3 inches above the pile and the temperature monitored through several feed cycles during Run 03. The feed cycles last up to several minutes. The temperature data are shown in Table 5-1. The high and low temperatures for the three piles varied significantly between feed cycles.

During Run 02, the temperature of the pile for screw feeder #1 was measured 1 inch above the top of the bed where it ranged from 800 to 1,100°F; at the surface of the pile, the temperature ranged from 1,250 to 1,400°F. The temperature probe was placed 1 inch into the bed where the temperature ranged from 220 to 900°F. The temperature profile data indicate that the combusting wood fuel in the primary chambers can be exposed to temperatures ranging from a low of 200°F to a high of approximately 1,700°F.

The secondary chamber temperature was measured by inserting a temperature probe 8 feet into the three secondary chamber access doors. The average secondary chamber temperature was 1,650°F with about a 5 percent variation from the mean. The secondary chamber draft was steady at -0.02 inches of water.

Mean values for the boiler operating parameters for the three test runs are shown in Table 5-2. The mean values for the three test runs are also averaged for a mean value for the entire three day test period. The individual data points are contained in Appendix B.

Typical operation of boiler WFB-A, as reported by the plant, is 50,000 lb/hr steam ± 10,000 lb/hr. During the test days, the boiler load varied a maximum of 7 percent from the mean of 46,800 lb/hr, and thus operated at a typical load. Based on a heat requirement of 1,100 Btu/lb steam produced, the average efficiency of the boiler was calculated to be 44 percent. With a wood feed moisture content of about 50 percent, this boiler efficiency is considered reasonable.[4]

TABLE 5-1. TEMPERATURE VARIATIONS 3 INCHES ABOVE THE PILE IN THE PRIMARY COMBUSTION CHAMBERS

Feeding Cycles	Primary Chamber Temperatures (^{o}F) 3" Above Pile (range--low to high)		
	Chamber #1	Chamber #2	Chamber #3
1	884-1189	1215-1680	1310-1674
2	712-987	1540-1655	1572-1615
3	987-1457	1157-1480	1382-1729
4	1370-1473	1177-1570	1634-1708

TABLE 5-2. BOILER WFB-A OPERATING DATA

Parameter	Run 01	Run 02	Run 03	Average (Runs 01 to 03)
Wood fuel feed rate (lb/hr,wet)	-	-	-	24,650[1] (12.3 tons/hr)
Steam flowrate (lb/hr)	43500	49400	47500	46800
Boiler Efficiency (%)				44
Secondary Combustion Chamber Draft (in H_2O)	-0.03	-0.02	-0.02	-0.02
Secondary Combustion Chamber Temperature (^oF)[3]	NM	1570	1720	1650
Boiler Outlet Flue Gas Temperature (^oF)[2]	657	688	663	669
Air heater exit temperature (^oF)[2]	555	585	571	570
Overfire Combustion Air Pressure (in H_2O)	0.07	0.1	0.01	0.06

[1] This feed rate is an average feed rate for the three test days. The wood fuel is fed intermittently to the top of piles in the three primary chambers and the wood fuel feed rate is not measured by the plant. Thus, this feed rate is based on the average CO_2 emitted from the boiler over the three test days.

[2] Temperatures measured by plant.

[3] Temperature measured by Radian.

NM = Not measured

The primary chambers ash pits were at an average positive draft of 1.0 inches of water, as the underfire air is supplied through these chambers. The overfire air was supplied at an average pressure of 0.06 inches of water.

The flue gas temperature as measured by the plant was at an average of 669°F for the 3-day test period. The temperature varied about 3 percent from the mean for the three test runs.

5.1.2 Baghouse Operating Data

The overall pressure drop across the baghouse controls the baghouse cleaning cycles. The setpoint was adjusted so that the baghouse was in a continuous cleaning cycle mode. When operating in a continuous cleaning cycle mode, the duration of the cleaning cycle was measured at 8 minutes. The setpoint is typically set at a pressure drop of 13 to 14.5 inches of water. The average pressure drops measured during the test periods are shown in Table 5-3. The individual data points are contained in Appendix B. The average pressure drop for the test periods was 13.5 inches of water, which is within the typical range for a baghouse.

Also shown in Table 5-3, are the inlet and outlet temperatures to the baghouse and the gas flowrates into the baghouse. The inlet gas temperature averaged 484°F for the test periods. During Run 02, the high temperature alarm was triggered as the inlet gas temperature reached 500°F, which is the alarm setpoint.

The baghouse treated an average of 86,720 acfm (at 480°F) of flue gas during the test periods. The baghouse is rated at 100,000 acfm.

5.2 FLUE GAS PARAMETER DATA

Tables 5-4 and 5-5 summarize flue gas data from the baghouse inlet sampling location and the baghouse outlet sampling location, respectively, at Site WFB-A. Flue gas parameters that were measured included temperature, moisture, volumetric flowrate, and oxygen concentration. The values of these parameters were consistent between test runs at both tested locations.

As shown in Table 5-4, the average flue gas temperature and moisture content measured at the baghouse inlet location were 253°C (487°F), and 12.6 percent volume, respectively. The average inlet gas flowrate under

TABLE 5-3. BAGHOUSE OPERATING DATA

Parameter	Run 1	Run 2[1]	Run 3	Average (runs 1-3)
Pressure drop across baghouse (inches H_2O)	13.1	14.0	13.5	13.5
Gas Flowrate into Baghouse (dscfm)	43840	41140	40900	41960
(acfm)	88820	86985	84350	86720
Inlet Temperature (°F)[1,2]	469	500	482	484
Outlet Temperature (°F)[3]	424	446	435	435

[1] High temperature alarm triggered at 500°F.

[2] Temperature measured by plant.

[3] Temperature measured by Radian.

TABLE 5-4. FLUE GAS PARAMETERS AT SITE WFB-A BAGHOUSE INLET[a]

Flue Gas Parameters	Run 01	Run 02	Run 03	Average
Temperature °C	244	260	254	253
Moisture (vol %)	12.0	13.5	12.2	12.6
Volumetric Flow Rate				
Actual (acmm)	2515	2463	2389	2456
Dry Standard (dscmm)	1242	1165	1158	1188
Oxygen Content (vol %)				
Radian CEM	13.3	12.8	13.0	13.0
EPA Method 4	13.3	13.9	13.9	13.7

[a] Metric units are reported for all flue gas measurement data. To convert to alternate units:

°F = 1.8 x °C + 32

cfm = cmm x 35.3

TABLE 5-5. FLUE GAS PARAMETERS AT SITE WFB-A BAGHOUSE OUTLET[a]

Flue Gas Parameters	Run 01	Run 02	Run 03	Average
Temperature (°C)	218	230	224	224
Moisture (vol %)	11.1	12.6	8.6	10.8
Volumetric Flow Rate				
Actual (acmm)	2,466	2,486	2,285	2,412
Dry Standard (dscmm)	1,244	1,208	1,173	1,208
Oxygen Content (vol %)				
Radian CEM	NA[b]	NA	NA	NA
EPA Method 4	15.9	15.2	16.2	15.8

[a] Metric units are reported for all flue gas measurement data.

To convert to alternate units:

$$°F = 1.8 \times °C + 32$$

$$cfm = cmm \times 35.3$$

[b] Not available. CEM data available from baghouse inlet location only.

actual stack temperature and moisture conditions was 2,456 acmm (86,693 acfm), and the average dry standard flowrate was 118 dscmm (41,951 dscfm). Standard EPA conditions are 20°C (68°F) and one atmosphere.

Flue gas oxygen concentrations at the baghouse inlet location were obtained from the Radian CEM system, and from integrated bag samples (EPA Method 4). The average O_2 concentrations of the flue gas as measured by these two techniques were 13.0 volume percent and 13.7 volume percent, respectively. The Radian CEM data will be used in subsequent sections of this report when normalizing as-measured flue gas concentrations of other species (e.g., dioxin, furan, CO, THC, etc.) to a reference oxygen level.

As shown in Table 5-5, the average flue gas temperature and moisture content measured at the baghouse outlet location were 224°C (435°F) and 10.8 percent volume, respectively. The average outlet gas flowrate under actual stack temperature and moisture conditions was 2,412 acmm (85,154 acfm), and the average dry standard flowrate was 1,208 dscmm (42,656 dscfm).

Flue gas oxygen concentrations at the baghouse outlet location were only obtained from integrated bag samples (EPA Method 4). The average O_2 concentration of the flue gas as measured by this technique was 15.8 volume percent.

5.3 CONTINUOUS EMISSIONS MONITORING DATA

Mean values and standard deviations of the continuously monitored combustion gases at the baghouse inlet location (O_2, CO, SO_2, NO_x, and THC) are shown for each MM5 test run in Table 5-6. The overall mean values for the three test runs are as follows: oxygen, 13.0 percent by volume (dry); carbon monoxide, 273 ppmv (dry at 3 percent O_2); carbon dioxide, 17.9 percent by volume (dry at 3 percent O_2); nitrogen oxides, 0.27 ppmv (dry at 3 percent O_2); and total hydrocarbons, 1.9 ppmv (wet at 3 percent O_2, as propane). The combustion gas results have been adjusted to the 3 percent oxygen reference basis for comparison to other combustion sources in the Tier 4 program. The unadjusted combustion gas results are included in Appendix D.

TABLE 5-6. MEAN VALUES AND STANDARD DEVIATIONS OF CONTINUOUSLY MONITORED COMBUSTION GASES AT THE INLET LOCATION

Parameter (a,b,c)	Run 01[a]	Run 02[a]	Run 03[a]	Overall Mean
02 (% vol)	13.3 (0.6)	12.8 (0.9)	13.0 (1.2)	13.0
CO (ppmv @ 3% 02)	211.7 (82.8)	239.8 (60.7)	366.5 (234.4)	272.7
CO_2 (% vol @ 3% 02)	18.3 (1.0)	17.7 (0.4)	17.7 (0.5)	17.9
NO_x (ppmv @ 3% 02)	0.3 (0.3)	0.2 (0.3)	0.3 (0.4)	0.27
THC (ppmv @ 3% 02)	0.3 (0.1)	4.5 (2.0)	1.0 (3.7)	1.9

[a] Mean values shown on top, with standard deviation below in parenthesis.

[b] Gas sampling for the continuous monitors was performed at the inlet location.

[c] All concentrations expressed on a dry volume basis except for total hydrocarbon concentrations, which are expressed on a wet volume basis.

[d] Total hydrocarbon data are expressed in units of ppmv (wet) as propane.

The mean oxygen and carbon dioxide concentrations showed little between-run variability. The maximum deviation between the mean concentration for any run and the overall mean value for all runs was less than 2 percent for these species. The mean carbon monoxide concentrations showed some variability between runs with a maximum variability of less than 35 percent between the mean concentration for any run and the overall mean value for all runs. Nitrogen oxide and total hydrocarbon concentrations had some variability, but were at low concentrations so that the variation was not significant. Also, the data did not show the expected positive relationship between carbon monoxide and total hydrocarbon concentrations.

Five-minute average values of the continuously monitored combustion gases are tabulated in Appendix D and are shown graphically as functions of time in Figures 5-1 through 5-5.

The boiler did not have an oxygen trim system, so the wood feed and combustion air flowrates were adjusted manually. The cyclic variation of the oxygen and carbon monoxide concentrations may have been caused by the simultaneous feeding of all three screwfeeders which may dampen combustion and cause oxygen and carbon monoxide concentrations to increase in a cyclic pattern.

5.4 MM5 DIOXIN/FURAN EMISSIONS DATA

5.4.1 Baghouse Inlet

Emissions concentration and emissions rate data measured at the baghouse inlet location are shown in Tables 5-7 and 5-8 for the 2378 TCDD, total PCDD, and total PCDF species. The data include dioxin and furan captured by the entire MM5 train, including the air filter, primary XAD sorbent trap, backup XAD sorbent trap, impingers, and sampled train cleanup rinses.

Isomer-specific analyses were performed on all outlet samples, but not on some inlet samples. Analysis of the inlet and outlet samples did indicate that the 2378 isomers were minor components (less than 25 percent) of total TCDD/TCDF concentrations in most cases. Isomer-specific analyses were performed on all samples in those cases where the first analysis (not isomer-specific) indicated that the 2378 isomers were present in higher than

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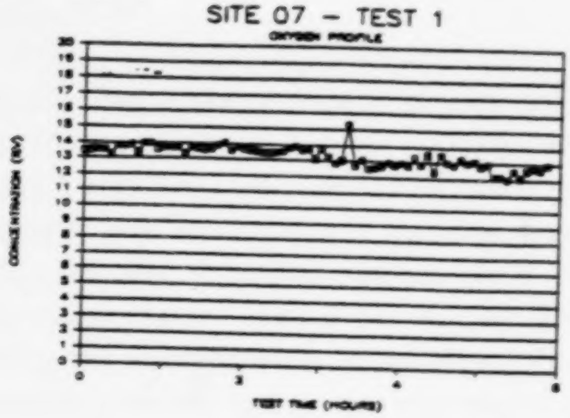
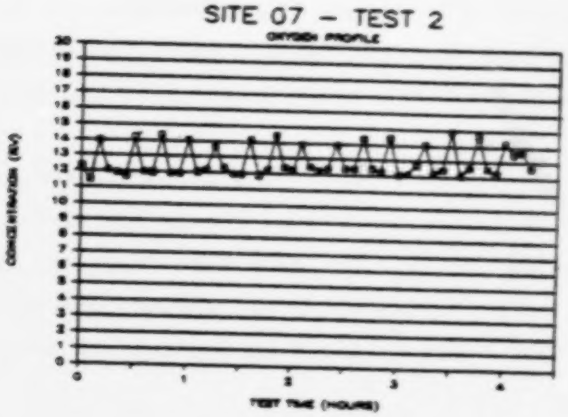
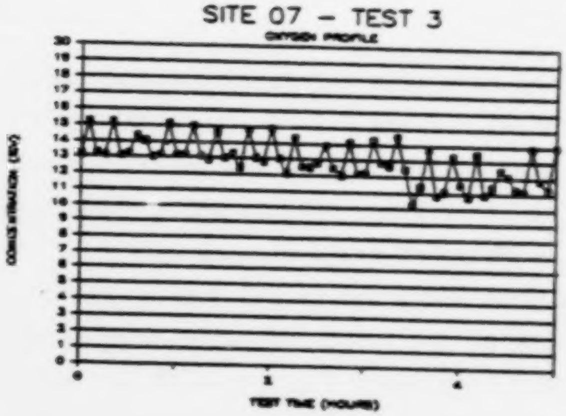


MEAN: 13.3% O2
STD. DEV.: 0.6%
INSTRUMENT RANGE: 0-25% O2

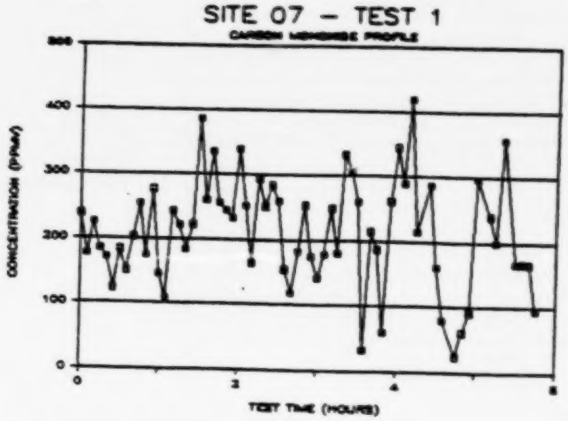


MEAN: 12.0% O2
STD. DEV.: 0.9%
INSTRUMENT RANGE: 0-25% O2

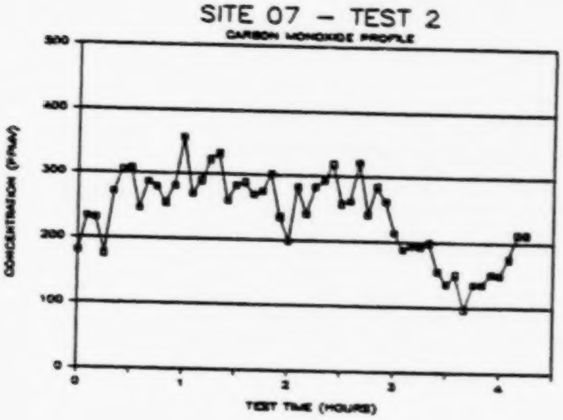


MEAN: 13.0% O2
STD. DEV.: 1.2%
INSTRUMENT RANGE: 0-25% O2

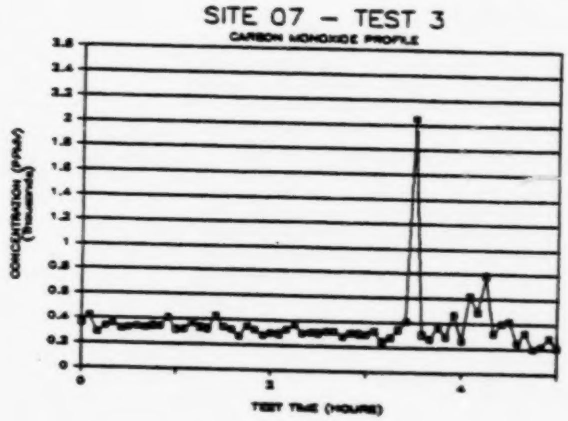
Figure 5-1. Oxygen Concentration History at Baghouse Inlet Location.



MEAN: 211.7 ppmv CO
STD. DEV.: 82.8 ppmv
INSTRUMENT RANGE: 0-6000 ppmv CO

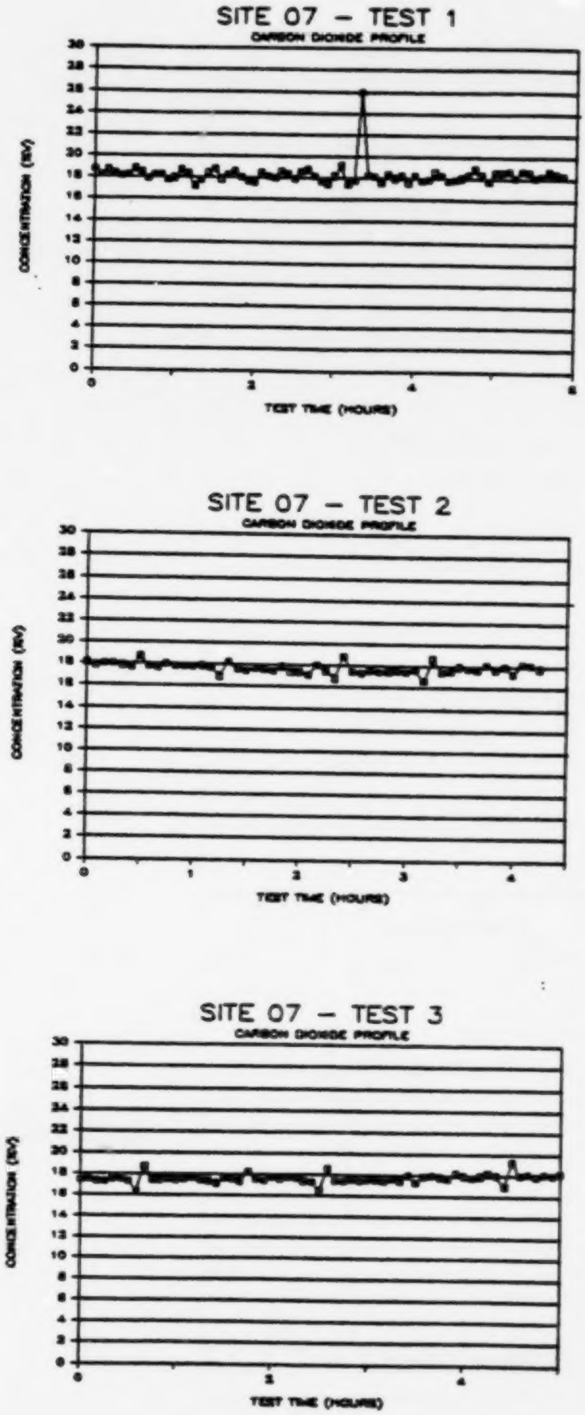


MEAN: 239.0 ppmv Co
STD. DEV.: 68.7 ppmv
INSTRUMENT RANGE: 0-6000 ppmv CO



MEAN: 336.3 ppmv CO
STD. DEV.: 234.4 ppmv
INSTRUMENT RANGE: 0-6000 ppmv CO

Figure 5-2. Carbon Monoxide Concentration History at Baghouse Inlet Location.

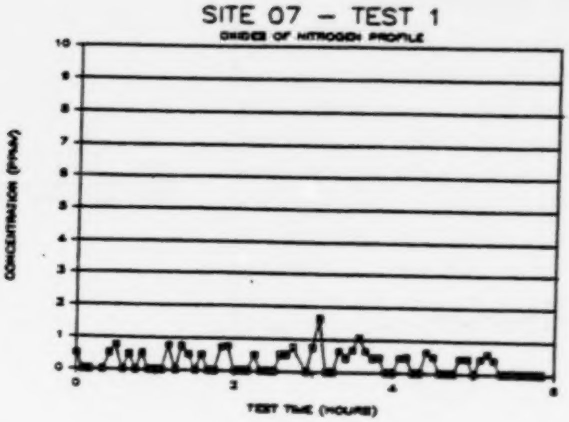


MEAN: 18.3% CO2
STD. DEV.: 1.0%
INSTRUMENT RANGE: 0-20% CO2

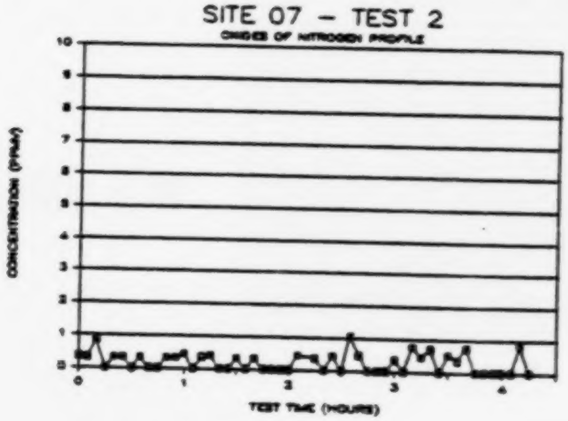
MEAN: 17.7% CO2
STD. DEV.: 0.4%
INSTRUMENT RANGE: 0-20% CO2

MEAN: 17.7% CO2
STD. DEV.: 0.5%
INSTRUMENT RANGE: 0-20% CO2

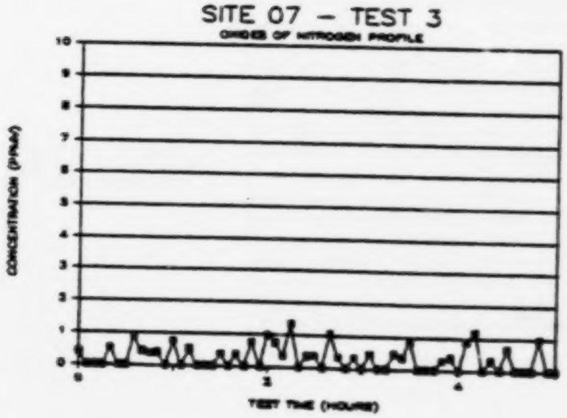
Figure 5-3. Carbon Dioxide Concentration History at Baghouse Inlet Location.



MEAN: 0.3 ppmv NOx
STD. DEV.: 0.3 ppmv
INSTRUMENT RANGE: 0-1000 ppmv NOx

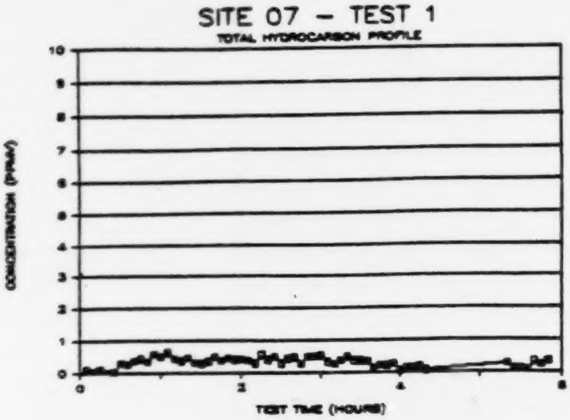


MEAN: 0.2 ppmv NOx
STD. DEV.: 0.3 ppmv
INSTRUMENT RANGE: 0-1000 ppmv NOx

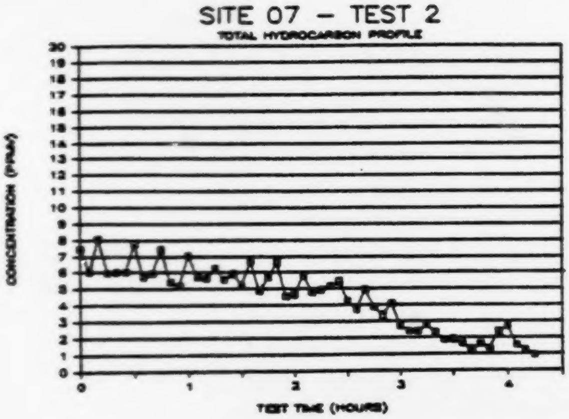


MEAN: 0.3 ppmv NOx
STD. DEV.: 0.4 ppmv
INSTRUMENT RANGE: 0-1000 ppmv NOx

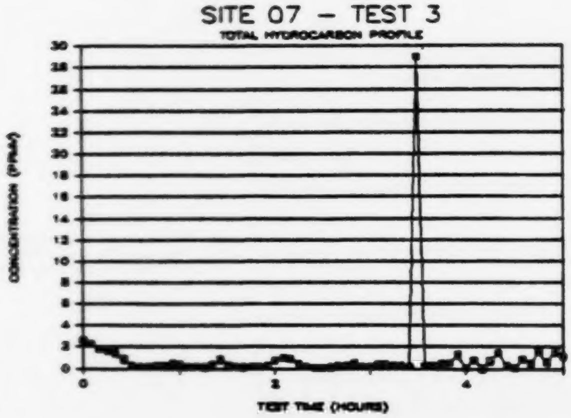
Figure 5-4. Nitrogen Oxide Concentration History at Baghouse Inlet Location.



MEAN: 0.3 ppmv THC
STD. DEV.: 0.1 ppmv
INSTRUMENT RANGE: 0-500 ppmv THC



MEAN: 4.3 ppmv THC
STD. DEV.: 2.0 ppmv
INSTRUMENT RANGE: 0-100 ppmv THC



MEAN: 1.0 ppmv THC
STD. DEV.: 3.7 ppmv
INSTRUMENT RANGE: 0-100 ppmv THC

Figure 5-5. Total Hydrocarbon Concentration History at Baghouse Inlet Location.

TABLE 5-7. OVERVIEW OF DIOXIN AND FURAN EMISSIONS CONCENTRATION DATA FOR SITE WFB-A (BAGHOUSE INLET LOCATION)

Run Number	Emissions Concentration, ng/dscm 2378-TCDD	 Total PCDD	 Total PCDF
ng/dscm, (as-measured)			
Run 01	NR	27.5	39.1
Run 02	0.37	39.6	70.8
Run 03	0.32	44.5	75.9
Average	0.34	40.9	62.7
ng/dscm @ 3% O_2[a]			
Run 01	NR	64.4	91.3
Run 02	0.94	101.0	180.0
Run 03	0.81	113.0	192.0
Average	0.87	102.0	156.0

---

[a] Flue gas concentration data corrected to 3% O_2 using the Radian CEM data in Table 5-4.

NR = not reported by Troika. 2378-TCDD and 2378-TCDF were minor components of respective total amounts of TCDD's/TCDF's.

TABLE 5-8. SUMMARY OF DIOXIN AND FURAN EMISSION RATES FOR SITE WFB-A (BAGHOUSE INLET LOCATION)

Run Number	Dioxin/Furan Emission Rate, ug/hr		
	2378-TCDD	Total PCDD	Total PCDF
Run 01	NR	2,050	2,910
Run 02	25.9	2,770	4,950
Run 03	22.1	3,090	5,280
Average	24.0	2,640	4,380

NR = not reported by Troika. 2378-TCDD and 2378-TCDF were minor components of total amounts of TCDD's/TCDF's.

normal or expected concentrations. As a result, in the following sections it will be noted that for some isomer-specific analyses the results were not reported (NR) by Troika. In these cases, it should be assumed that the 2378 isomers are a minor component of the total TCDD/TCDF concentrations.

As shown in Table 5-7, at the baghouse inlet location average as-measured emission concentrations of 2378-TCDD, total PCDD, and total PCDF species were 0.34 ng/dscm 2378-TCDD, 40.9 ng/dscm total PCDD, and 62.7 ng/dscm total PCDF. When corrected to 3 percent O_2 using the Radian CEM oxygen concentration data, these values correspond to 0.87 ng/dscm 2378-TCDD at 3 percent O_2, 102.0 ng/dscm total PCDD at 3 percent O_2, and 156.0 ng/dscm total PDCF at 3 percent O_2.

In Table 5-8, dioxin and furan emission rates at the baghouse inlet location for Site WFB-A are shown. Average emission rates for the three species were 24 ug/hr 2378-TCDD, 2,640 ug/hr total PCDD, and 4,380 ug/hr total PCDF. Emissions of total PCDD and total PCDF were consistent between test runs. The maximum deviation of any individual run from the overall average was approximately 23 percent for total PCDD emissions, and 34 percent for total PCDF emissions.

Tables 5-9 and 5-10 present isomer- and homologue-specific emission concentration data from the baghouse inlet location for the three test runs. Table 5-9 presents the isomer concentration data at as-measured oxygen conditions; Table 5-10 presents the isomer concentration data corrected to 3 percent O_2. Also, run-specific data tables showing homologue emission concentrations in both ng/dscm and parts-per-trillion units as well as homologue emission rates in ug/hr units are included in Appendix J.

Detectable quantities of each isomer and homologue analyzed for were found in baghouse inlet MM5 samples at Site WFB-A with the exception of the OCDF species which was below the detectable limit for Run 01. However, values for Run 01 were not reported by the analytical laboratory for 2378-TCDD, penta-CDD, and 2378-TCDF. Both 2378-TCDD and 2378-TCDF were minor components of respective total amounts of TCDD's and TCDF's. Figure 5-6 is a histogram showing the relative distributions (mole basis) of the

TABLE 5-9. SUMMARY OF DIOXIN/FURAN EMISSIONS DATA FROM BAGHOUSE INLET LOCATION FOR SITE WFB-A

Dioxin/Furan Isomer	Isomer Concentration in Flue Gas (ng/dscm)			
	Run 01	Run 02	Run 03	Avg.
DIOXINS				
2378 TCDD	NR	3.70E-01	3.18E-01	3.44E-01
Other TCDD	4.78E+00	8.72E+00	1.24E+01	8.62E+00
Penta-CDD	NR	1.02E+01	1.16E+01	1.09E+01
Hexa-CDD	4.92E+00	1.02E+01	1.18E+01	8.98E+00
Hepta-CDD	9.07E+00	8.12E+00	6.62E+00	7.94E+00
Octa-CDD	8.77E+00	1.97E+00	1.73E+00	4.16E+00
Total PCDD	2.75E+01	3.96E+01	4.45E+01	4.09E+01
FURANS				
2378 TCDF	NR	2.31E+00	2.31E+00	2.31E+00
Other TCDF	2.98E+01	4.33E+01	4.75E+01	4.02E+01
Penta-CDF	4.70E+00	1.65E+01	1.68E+01	1.27E+01
Hexa-CDF	3.25E+00	5.90E+00	6.81E+00	5.32E+00
Hepta-CDF	1.31E+00	2.54E+00	2.23E+00	2.02E+00
Octa-CDF	ND(3.17E+00)	2.56E-01	2.31E-01	1.63E-01
Total PCDF	3.91E+01	7.08E+01	7.59E+01	6.27E+01

NOTE: Isomer concentrations shown are at as-measured oxygen conditions.
NR = not reported by Troika. 2378-TCDD and 2378-TCDF are minor components of total respective amounts of TCDD's/TCDF's.
ND = not detected (detection limit in parentheses).
ng = 1.0E-09g
8760 operating hours per year

TABLE 5-10. SUMMARY OF DIOXIN/FURAN EMISSIONS DATA FROM BAGHOUSE INLET LOCATION FOR SITE WFB-A . (Concentrations Corrected to 3% Oxygen)

Dioxin/Furan Isomer	Isomer Concentration in Flue Gas (ng/dscm @ 3% oxygen) Run 01	Run 02	Run 03	Avg.
DIOXINS				
2378 TCDD	NR	9.39E-01	8.06E-01	8.73E-01
Other TCDD	1.12E+01	2.21E+01	3.13E+01	2.15E+01
Penta-CDD	NR	2.60E+01	2.95E+01	2.78E+01
Hexa-CDD	1.15E+01	2.59E+01	2.99E+01	2.25E+01
Hepta-CDD	2.12E+01	2.06E+01	1.68E+01	1.95E+01
Octa-CDD	2.05E+01	4.98E+00	4.40E+00	9.96E+00
Total PCDD	6.44E+01	1.01E+02	1.13E+02	1.02E+02
FURANS				
2378 TCDF	NR	5.85E+00	5.86E+00	5.86E+00
Other TCDF	6.97E+01	1.10E+02	1.20E+02	1.00E+02
Penta-CDF	1.10E+01	4.19E+01	4.26E+01	3.18E+01
Hexa-CDF	7.60E+00	1.50E+01	1.73E+01	1.33E+01
Hepta-CDF	3.07E+00	6.43E+00	5.64E+00	5.05E+00
Octa-CDF	ND(7.41E+00)	6.50E-01	5.86E-01	4.12E-01
Total PCDF	9.13E+01	1.80E+02	1.92E+02	1.56E+02

NOTE: Isomer concentrations shown are corrected to 3% oxygen.
NR = not reported by Troika. 2378-TCDD and 2378-TCDF are minor components of total respective amounts of TCDD's/TCDF's.
ng = 1.0E-09g
8760 operating hours per year

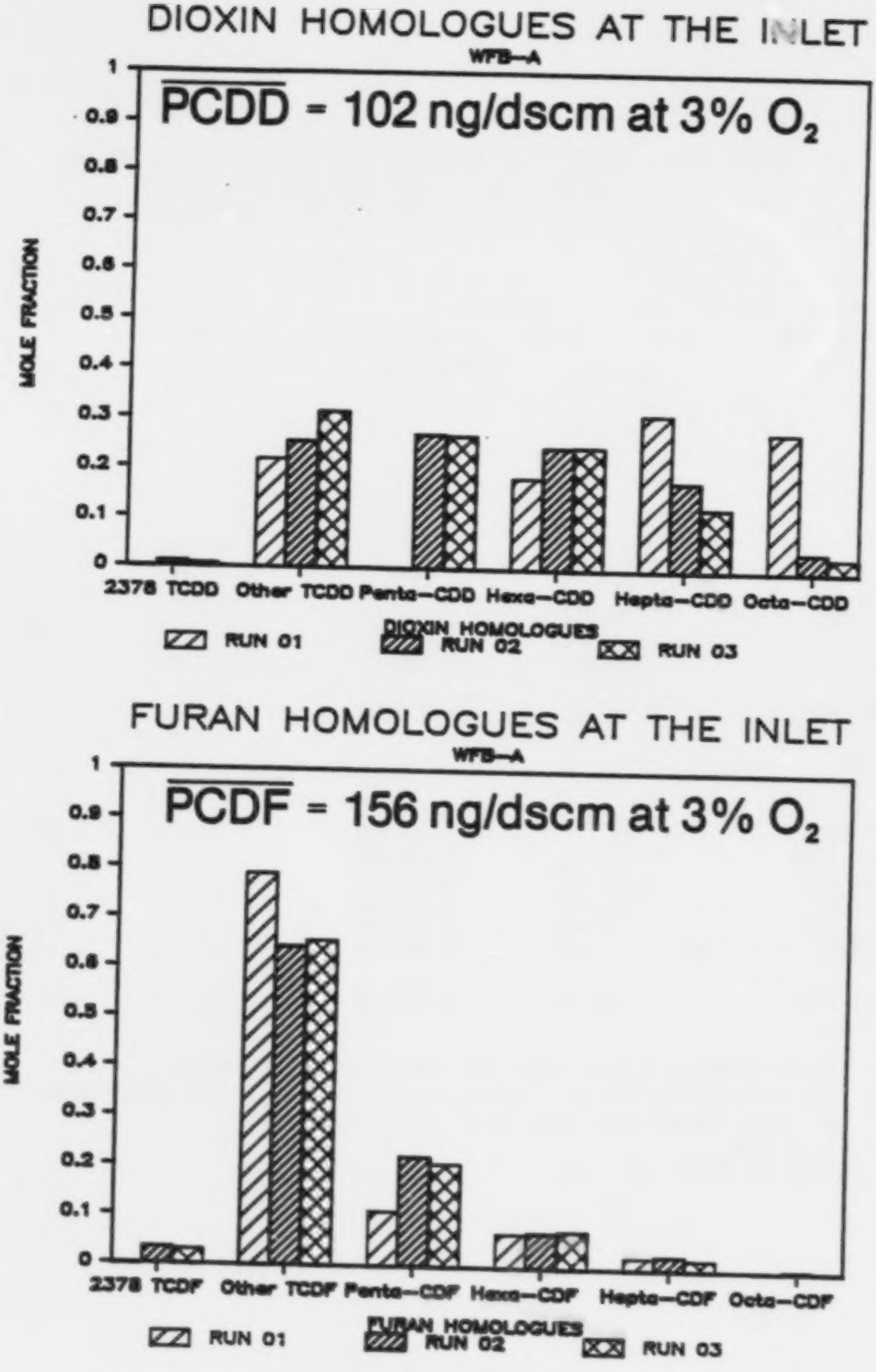


Figure 5-6. Dioxin and furan homologue distributions of the baghouse inlet emissions for Site WFB-A.

2378-TCDD/TCDF isomers and the tetra through octa PCDD/PCDF homologues in the baghouse inlet emissions. The distribution of dioxin species was fairly consistent among the three test runs. The 2378-TCDD isomer accounted for about 1 percent of the total dioxins analyzed for, which corresponded to about 2 to 4 percent of the tetra homologue total from each test run. The contributions of the tetra through octa chlorinated dioxin homologues to the total PCDD emissions were: tetra, 22 to 32 percent; penta, 26 percent; hexa, 19 to 25 percent; hepta, 13 to 32 percent; and octa, 3 to 28 percent.

The distribution of furan species in baghouse inlet emissions was also fairly consistent among the three test runs. The tetrachlorinated furan homologue was the largest single contributor to the total PCDF emissions. The contributions of the tetra through octa chlorinated furan homologues to the total PCDF emissions were: tetra, 68 to 79 percent; penta, 11 to 22 percent; hexa, 7 to 8 percent; hepta, 2 to 28 percent; and octa, 0 to 0.3 percent.

Uncontrolled emission factors based on the furnace feed rates (dry wood basis) are shown in Table 5-11. Average uncontrolled emission factors for 2378 TCDD, total PCDD, and total PCDF were 0.004 ug of 2378-TCDD emitted per kg of dry wood feed, 0.49 ug of total PCDD emitted per kg of dry wood feed, and 0.75 ug of total PCDF emitted per kg of dry wood feed.

As shown in Table 5-11, uncontrolled emission factors for 2378-TCDD, total PCDD, and total PCDF were fairly consistent between the three test runs.

5.4.2 Baghouse Outlet

Emissions concentration and emissions rate data measured at the baghouse outlet location are shown in Table 5-12 and 5-13 for the 2378 TCDD, total PCDD, and total PCDF species. The data include dioxin and furan captured by the entire MM5 train, including the filter, primary XAD sorbent trap, backup XAD sorbent trap, impingers, and sample train cleanup rinses.

As shown in Table 5-12, average as-measured emission concentrations of the 2378-TCDD, total PCDD, and total PCDF species were 0.08 ng/dscm 2378-TCDD, 57.6 ng/dscm total PCDD, and 24.8 ng/dscm total PCDF. When corrected to 3 percent O_2 using the Radian CEM oxygen concentration data,

TABLE 5-11. DIOXIN/FURAN EMISSION FACTORS FOR BAGHOUSE INLET LOCATION OF SITE WFB-A.

Dioxin/Furan Isomer	Dioxin/Furan Emission Factors (ug/kg)			
	Run 01	Run 02	Run 03	Avg.
DIOXINS				
2378 TCDD	NR	4.39E-03	3.75E-03	4.07E-03
Other TCDD	6.04E-02	1.03E-01	1.46E-01	1.03E-01
Penta-CDD	NR	1.21E-01	1.37E-01	1.29E-01
Hexa-CDD	6.21E-02	1.21E-01	1.39E-01	1.07E-01
Hepta-CDD	1.15E-01	9.62E-02	7.80E-02	9.63E-02
Octa-CDD	1.11E-01	2.33E-02	2.04E-02	5.15E-02
Total PCDD	3.48E-01	4.70E-01	5.24E-01	4.91E-01
FURANS				
2378 TCDF	NR	2.74E-02	2.72E-02	2.73E-02
Other TCDF	3.76E-01	5.13E-01	5.60E-01	4.83E-01
Penta-CDF	5.94E-02	1.96E-01	1.98E-01	1.51E-01
Hexa-CDF	4.11E-02	6.99E-02	8.02E-02	6.37E-02
Hepta-CDF	1.66E-02	3.01E-02	2.62E-02	2.43E-02
Octa-CDF	ND(4.00E-02)	3.04E-03	2.72E-03	1.92E-03
Total PCDF	4.93E-01	8.40E-01	8.94E-01	7.52E-01

NR = not reported by Troika. 2378-TCDD and 2378-TCDF are minor components of total respective amounts of TCDD's/TCDF's.
ND = not detected (detection limit in parentheses).
ug = 1.0E-06g
8760 operating hours per year

NOTE: Emission factors are based on the dry wood feed rate.

TABLE 5-12. OVERVIEW OF DIOXIN AND FURAN EMISSIONS CONCENTRATION DATA FOR SITE WFB-A (BAGHOUSE OUTLET LOCATION)

Run Number	Emissions Concentration, ng/dscm 2378 TCDD	 Total PCDD	 Total PCDF
ng/dscm (as-measured)			
Run 01	0.06	62.6	23.5
Run 02	0.09	77.5	37.3
Run 03	0.09	32.6	13.5
Average	0.08	57.6	24.8
ng/dscm @ 3% O_2[a]			
Run 01	0.21	221.0	82.9
Run 02	0.27	240.0	116.0
Run 03	0.35	122.0	50.8
Average	0.28	194.3	83.2

---

[a] Flue gas concentration data corrected to 3% O_2 using the Radian CEM data in Table 5-4.

TABLE 5-13. SUMMARY OF DIOXIN AND FURAN EMISSION RATES FOR SITE WFB-A (BAGHOUSE OUTLET LOCATION)

Run Number	Dioxin/Furan Emission Rate, ug/hr		
	2378 TCDD	Total PCDD	Total PCDF
Run 01	4.5	4,670	1,750
Run 02	6.4	5,610	2,700
Run 03	6.6	2,300	954
Average	5.8	4,190	1,800

these values correspond to 0.28 ng/dscm 2378-TCDD at 3 percent O_2, 194.3 ng/dscm total PCDD at 3 percent O_2, and 83.2 ng/dscm total PCDF at 3 percent O_2.

In Table 5-13, dioxin and furan emission rates for Site WFB-A are shown. Average emission rates for the three species were 5.8 ug/hr 2378-TCDD, 4,190 ug/hr total PCDD, and 1,800 ug/hr total PCDF. Emission rates of 2378-TCDD, total PCDD and total PCDF were fairly consistent between the three test runs. For 2378-TCDD emissions the maximum deviation of any individual run from the overall average of three runs was approximately 23 percent. Total PCDD and total PCDF emissions varied the most from the overall average during test Run 03. Total PCDD emissions were 45 percent lower than the average and total PCDF emissions were 48 percent lower than the average during Run 03.

Tables 5-14 and 5-15 present isomer- and homologue-specific emission concentration data for the three test runs. Table 5-14 presents the isomer concentration data at as-measured oxygen conditions; Table 5-15 presents the isomer concentration data corrected to 3 percent O_2. Also, run-specific data tables showing homologue emission concentrations in both ng/dscm and parts-per-trillion units as well as homologue emission rates in ug/hr units are included in Appendix J.

Detectable quantities of each isomer and homologue analyzed for were found in the baghouse outlet emissions at Site WFB-A. Figure 5-7 is a histogram showing the relative distributions (mole basis) of the 2378 TCDD/TCDF isomers and the tetra through octa PCDD/PCDF homologues in the baghouse outlet emissions. The distribution of dioxin species was fairly consistent among the three test runs. The 2378-TCDD isomer accounted for 0.1 to 0.3 percent of the total dioxins analyzed for, which corresponds to roughly 0.4 to 1.2 percent of the tetra homologue total from three individual test runs. The contributions of the tetra through octa chlorinated dioxin homologues to the total PCDD emissions were: tetra, 25 to 31 percent; penta, 20 to 29 percent; hexa, 19 to 28 percent; hepta, 14 to 26 percent; and octa, 4 to 8 percent.

TABLE 5-14. SUMMARY OF DIOXIN/FURAN EMISSIONS DATA FROM BAGHOUSE OUTLET LOCATION OF SITE WFB-A.

Dioxin/Furan Isomer	Isomer Concentration in Flue Gas (ng/dscm)			
	Run 01	Run 02	Run 03	Avg.
DIOXINS				
2378 TCDD	6.01E-02	8.80E-02	9.38E-02	8.06E-02
Other TCDD	1.39E+01	2.07E+01	7.58E+00	1.41E+01
Penta-CDD	1.77E+01	1.90E+01	6.08E+00	1.42E+01
Hexa-CDD	1.82E+01	1.94E+01	6.23E+00	1.46E+01
Hepta-CDD	9.91E+00	1.46E+01	9.44E+00	1.13E+01
Octa-CDD	2.82E+00	3.70E+00	3.22E+00	3.25E+00
Total PCDD	6.26E+01	7.75E+01	3.26E+01	5.76E+01
FURANS				
2378 TCDF	3.90E-01	5.87E-01	5.63E-01	5.13E-01
Other TCDF	9.88E+00	1.68E+01	6.70E+00	1.11E+01
Penta-CDF	6.79E+00	9.93E+00	4.00E+00	6.90E+00
Hexa-CDF	4.26E+00	6.66E+00	1.09E+00	4.00E+00
Hepta-CDF	1.80E+00	3.06E+00	1.00E+00	1.96E+00
Octa-CDF	3.60E-01	2.49E-01	1.88E-01	2.66E-01
Total PCDF	2.35E+01	3.73E+01	1.35E+01	2.48E+01

NOTE: Isomer concentrations shown are at as-measured oxygen conditions.

ND = not detected (detection limit in parentheses).
ng = 1.0E-09g
8760 operating hours per year

TABLE 5-15. SUMMARY OF DIOXIN/FURAN EMISSIONS DATA FROM BAGHOUSE OUTLET LOCATION OF SITE WFB-A. (Concentrations Corrected to 3% Oxygen)

Dioxin/Furan Isomer	Isomer Concentration in Flue Gas (ng/dscm @ 3% oxygen) Run 01	Run 02	Run 03	Avg.
DIOXINS				
2378 TCDD	2.12E-01	2.73E-01	3.52E-01	2.79E-01
Other TCDD	4.90E+01	6.44E+01	2.84E+01	4.73E+01
Penta-CDD	6.24E+01	5.89E+01	2.28E+01	4.80E+01
Hexa-CDD	6.42E+01	6.01E+01	2.34E+01	4.92E+01
Hepta-CDD	3.50E+01	4.54E+01	3.54E+01	3.86E+01
Octa-CDD	9.96E+00	1.15E+01	1.21E+01	1.12E+01
Total PCDD	2.21E+02	2.40E+02	1.22E+02	1.95E+02
FURANS				
2378 TCDF	1.38E+00	1.82E+00	2.11E+00	1.77E+00
Other TCDF	3.49E+01	5.22E+01	2.51E+01	3.74E+01
Penta-CDF	2.40E+01	3.08E+01	1.50E+01	2.33E+01
Hexa-CDF	1.51E+01	2.07E+01	4.10E+00	1.33E+01
Hepta-CDF	6.36E+00	9.51E+00	3.75E+00	6.54E+00
Octa-CDF	1.27E+00	7.74E-01	7.03E-01	9.16E-01
Total PCDF	8.29E+01	1.16E+02	5.08E+01	8.32E+01

NOTE: Isomer concentrations shown are corrected to 3% oxygen.

ND = not detected (detection limit in parentheses).
ng = 1.0E-09g
8760 operating hours per year

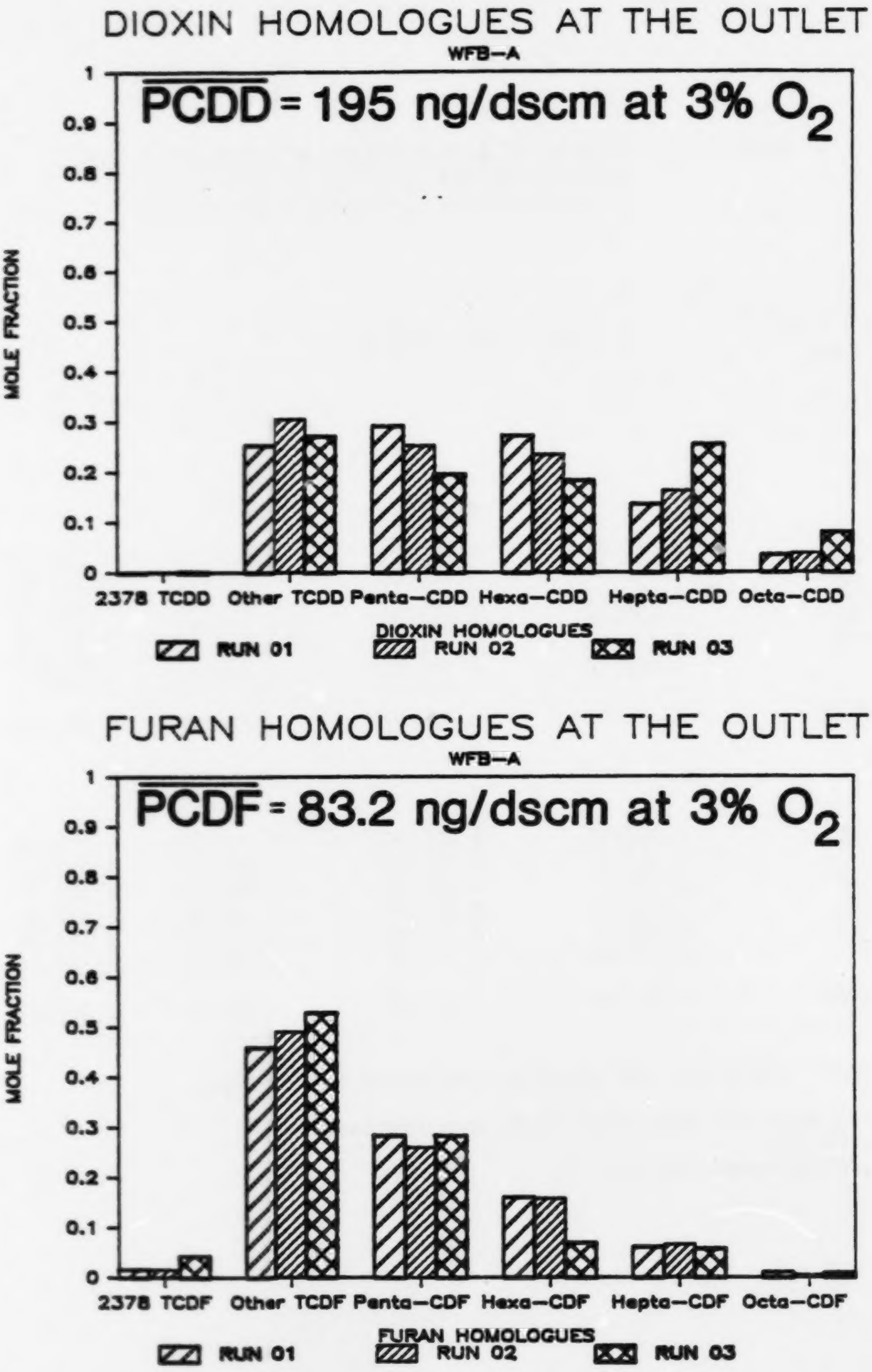


Figure 5-7. Dioxin and furan homologue distributions of the baghouse outlet emissions for Site WFB-A.

The distribution of furan species was also fairly consistent among the three test runs. The tetrachlorinated furan homologue was the largest single contributor to the total PCDF emissions. The contributions of the tetra through octa chlorinated furan homologues to the total PCDF emissions were: tetra, 48 to 58 percent; penta, 26 to 29 percent; hexa, 7 to 16 percent; hepta, 6 to 7 percent; and octa, 0.5 to 1.2 percent.

Emission factors based on the furnace feed rates are shown in Table 5-16. Average emission factors for 2378-TCDD, total PCDD, and total PCDF were 0.0099 ug of 2378-TCDD emitted per kg of feed, 0.71 ug of total PCDD emitted per kg of feed, and 0.31 ug of total PCDF emitted per kg of feed. Emission factors for 2378-TCDD, total PCDD, and total PCDF were fairly consistent between the three test runs.

5.4.3 Baghouse Removal Efficiency

The dioxin/furans which condense on particulate in the stack gas are removed from the stack gas along with the particulate by the pollution control device. The dioxin/furan removal efficiency of the control device is calculated from the difference of the inlet and outlet concentration of each dioxin/furan homologue divided by the inlet concentration of each homologue. Each value may have an analytical uncertainty of ± 50 percent. An analysis of the uncertainty of the control device efficiency (contained in Appendix G) indicates that with a measured efficiency of greater than 66.7 percent, the removal efficiency is most likely positive. With measured efficiencies between 66.7 percent and -200 percent, a definite conclusion cannot be drawn concerning the true removal efficiency, and below -200 percent, the removal efficiency is most likely negative.

The removal efficiency results in Table 5-17 suggest that the baghouse exhibited negative control for PCDD's (i.e., increases in concentration across the baghouse) and positive control for PCDF's. The average measured total PCDD removal efficiency of the baghouse was -130 percent, and the average measured total PDCF removal efficiency was +39 percent. The measured control efficiency values for individual PCDD homologues were typically within the range explainable by low positive removal efficiency and the

TABLE 5-16. DIOXIN/FURAN EMISSION FACTORS FOR BAGHOUSE OUTLET LOCATION OF SITE WFB-A.

Dioxin/Furan Isomer	Dioxin/Furan Emission Factors (ug/kg)			
	Run 01	Run 02	Run 03	Avg.
DIOXINS				
2378 TCDD	7.60E-04	1.08E-03	1.12E-03	9.87E-04
Other TCDD	1.76E-01	2.55E-01	9.05E-02	1.74E-01
Penta-CDD	2.24E-01	2.33E-01	7.26E-02	1.77E-01
Hexa-CDD	2.30E-01	2.38E-01	7.44E-02	1.81E-01
Hepta-CDD	1.25E-01	1.80E-01	1.13E-01	1.39E-01
Octa-CDD	3.57E-02	4.54E-02	3.84E-02	3.98E-02
Total PCDD	7.92E-01	9.52E-01	3.90E-01	7.11E-01
FURANS				
2378 TCDF	4.94E-03	7.21E-03	6.71E-03	6.29E-03
Other TCDF	1.25E-01	2.07E-01	8.00E-02	1.37E-01
Penta-CDF	8.59E-02	1.22E-01	4.77E-02	8.52E-02
Hexa-CDF	5.40E-02	8.18E-02	1.31E-02	4.96E-02
Hepta-CDF	2.28E-02	3.77E-02	1.19E-02	2.41E-02
Octa-CDF	4.56E-03	3.06E-03	2.24E-03	3.29E-03
Total PCDF	2.97E-01	4.59E-01	1.62E-01	3.06E-01

ND = not detected (detection limit in parentheses).
ug = 1.0E-06g
8760 operating hours per year

TABLE 5-17. BAGHOUSE REMOVAL EFFICIENCIES AT SITE WFB-A

Run Number	Percent Removal by Baghouse		
	2378-TCDD	Total PCDD	Total PCDF
Run 01	NR	-243.2	9.2
Run 02	70.9	-137.6	35.6
Run 03	56.3	-8.0	73.5
Average	63.6	-129.6	39.4

NR = not reported by Troika. The 2378-TCDD isomer, if present, was a minor component of the total amount of TCDD's.

± 50 percent analytical uncertainty. However, the consistently negative values indicate negative control as another likely explanation of the data. The measured control efficiency values for PCDF's indicated a limited positive degree of control. Inlet concentration to the baghouse were large relative to the minimum detectable levels.

5.5 HCl TRAIN CHLORIDES EMISSIONS DATA

Table 5-18 summarizes HCl train chloride emissions data measured at the baghouse outlet sampling location. The data are reported as "front-half," "back-half," and "train-total" chloride emissions. The front-half emissions represent chlorides captured in the probe rinse/filter fraction of the HCl train, which may include metal chlorides contained in the particulate matter. The back-half emissions represent chlorides captured in the HCl sample train impingers, which would include HCl and any metal chlorides that pass through the sample train filter. The train total emissions represent the sum of the front-half and back-half emissions.

As shown in Table 5-18, the average as-measured train-total chloride emissions concentration was approximately 86 mg/dscm (0.037 gr/dscf). Corrected to 3 percent O_2 using the Radian CEM data, this corresponds to approximately 195 mg/dscm at 3 percent O_2 (0.085 gr/dscf). The average train-total chloride mass emission rate from the baghouse outlet was about 5.8 kg/hr (12.8 lb/hr). Chloride emissions were lower in the front-half of the HCl sample train, compared to the back-half of the HCl sample train.

In addition to the HCl train chloride emissions, samples of the wood feed and baghouse dust were analyzed for total chlorides. Table 5-19 summarizes the results of these analyses. Results from analysis of wood feed samples were fairly consistent between runs and averaged 140 ug Cl^-/gram of sample. By comparison, the baghouse outlet samples varied significantly between runs. The values ranged from 24,000 to 130,000 ug Cl^-/gram of sample for the three runs. The average chloride content for the baghouse dust was 58,000 ug Cl^-/gram sample.

TABLE 5-18. HCL TRAIN CHLORIDE EMISSIONS DATA FOR SITE WFB-A (BAGHOUSE OUTLET LOCATION)

Sample Component	Test Run	Emissions Concentration			Emissions Rate (kg/hr)
		mg/dscm	ppmv[a]	mg/dscm @ 3% O_2[b]	
Train Total	Run 01	77.59	52.61	182.74	5.34
	Run 02	95.42	64.70	210.87	7.05
	Run 03	83.96	56.93	190.24	4.92
	Average	85.66	58.08	194.61	5.77
Front-Half	Run 01	18.98	12.87	44.70	1.31
	Run 02	12.68	8.60	28.02	0.94
	Run 03	20.26	13.74	45.91	1.19
	Average	17.31	11.74	39.54	1.15
Back-Half	Run 01	58.61	39.74	138.04	4.03
	Run 02	82.74	56.10	182.85	6.11
	Run 03	63.70	43.19	144.33	3.73
	Average	68.35	46.34	155.07	4.62

---

[a] ppmv = parts per million chloride by volume, dry basis at actual stack O_2 concentration.

[b] Concentration corrected to 3% O_2 using the equation:

$[Cl^-]$ @ 3% O_2 = $[Cl^-]$, as measured x (20.9 - 3) / (20.9 - % O_2)

where:

% O_2 = oxygen concentration in stack gas as measured by the Radian CEM system (see Table 5-4).

TABLE 5-19. SUMMARY OF TOTAL CHLORIDE ANALYSIS FOR FEED AND BAGHOUSE DUST SAMPLES FOR SITE WFB-A

Sample Identification	Total Chloride Concentration (ug/g)			
	Run 01	Run 02[a]	Run 03	Average
Wood Feed	150	170; < 100	130	140
Baghouse Dust	130,000	25,000; 24,000	53,000	58,000

[a] Duplicate analysis of the same sample.

5.6 WOOD FEED PRECURSOR DATA AND PROCESS SAMPLE DIOXIN/FURAN ANALYSES

As discussed in Section 6.2.1, wood feed was collected as grab samples and combined into four 500 gram composite samples for each test run. Radian analyzed one of these samples for chlorinated benzene, chlorinated biphenyls, and chlorinated phenols. Table 5-20 summarizes the results of the compound-specific precursor analyses. As shown, none of the precursor compounds analyzed for were found in the wood feed samples.

Samples of ash from the primary and secondary combustion chambers along with baghouse dust samples were analyzed for dioxin/furan content. The analyses of the ash samples are summarized in Table 5-21. The dioxin/furan content in these ash samples was minimal. The highest total PCDD content of any individual bottom ash sample was approximately 0.3 parts per billion. In most of these samples a small amount of the hepta- and/or octa-CDD homologues were the only isomers detected. Table 5-22 summarizes the results of the dioxin/furan analyses of the baghouse dust samples. As shown, these samples contained significantly higher levels of PCDD/PCDF than the bottom ash samples. The highest total PCDD content of any individual baghouse dust sample was approximately 1200 parts per billion, and the highest total PCDF content was approximately 330 parts per billion. The consistency between runs was very good for the dioxin species. All of the homologues were present in the samples and contributed to the total PCDD emissions as follows: tetra, 16 to 20 percent; penta, 20 to 24 percent; hexa, 24 to 31 percent; hepta, 22 to 34 percent; and octa, 4 to 6 percent. The furan species were also very consistent between runs. The contributions of the tetra through octa chlorinated furan homologues to the total PCDF were: tetra, 47 to 52 percent; penta, 22 to 26 percent; hexa, 14 to 19 percent; hepta, 8 to 12 percent; and octa, 0.7 to 0.9 percent.

TABLE 5-20. SUMMARY OF DIOXIN PRECURSOR DATA FOR SITE WFB-A FEED SAMPLES

Precursor Categories	Precursor Concentration, ug/g (ppm)			
	Wood Feed Samples			
	Run 01	Run 02[a]	Run 03	Average
Total Chlorinated Benzenes	0	0,0	0	0
Total Chlorinated Biphenyls	0	0,0	0	0
Total Chlorinated Phenols	0	0,0	0	0

[a] Duplicate analysis of the same sample.

TABLE 5-21. DIOXIN/FURAN CONTENTS OF PRIMARY AND SECONDARY COMBUSTION CHAMBER BOILER BOTTOM ASH SAMPLES FROM SITE WFB-A

Isomer/ Homologue	Dioxin/Furan Homologue Content, Parts per Billion							
	Primary Chamber Ash				Secondary Chamber Ash			
	Run 01	Run 02	Run 03	Average	Run 01	Run 02	Run 03	Average
Dioxins								
2378 TCDD	NR	NR	NR	NR	NR	ND	NR	ND
Other TCDD	ND	NR	ND	ND	ND	ND	ND	ND
Penta CDD	ND	NR	ND	ND	ND	ND	ND	ND
Hexa CDD	ND	NR	ND	ND	ND	ND	ND	ND
Hepta CDD	0.2	NR	ND	0.1	ND	ND	ND	ND
Octa CDD	0.09	NR	0.01	0.05	0.03	ND	0.01	0.01
Total PCDD	0.29	NR	0.01	0.15	0.03	ND	0.01	0.01
Furans								
2378 TCDF	NR	NR	NR	NR	NR	ND	NR	ND
Other TCDF	ND	NR	ND	ND	ND	ND	ND	ND
Penta CDF	ND	NR	ND	ND	ND	ND	ND	ND
Hexa CDD	ND	NR	ND	ND	ND	ND	ND	ND
Hepta CDF	ND	NR	ND	ND	ND	ND	ND	ND
Octa CDF	ND	NR	ND	ND	ND	ND	ND	ND
Total PCDF	ND	NR	ND	ND	ND	ND	ND	ND

NR = not reported by Troika. 2378-TCDD and 2378-TCDF were minor components of respective total amounts of TCDD's/TCDF's.

ND = none detected. Detection limits ranged from 0.001 ppb to 0.1 ppb with an average detection limit of 0.01 ppb.

TABLE 5-22. DIOXIN/FURAN CONTENTS OF BAGHOUSE DUST SAMPLES FROM SITE WFB-A

Isomer/ Homologue	Dioxin/Furan Homologue Content, parts per billion			
	Baghouse Dust			
	Run 01	Run 02	Run 03	Average
Dioxins				
2378 TCDD	1.0	0.8	1.2	1.0
Other TCDD	193.5	223.8	210.1	209.1
Penta CDD	236.3	273.0	251.4	253.6
Hexa CDD	282.9	347.9	321.7	317.5
Hepta CDD	410.3	252.0	258.0	306.8
Octa CDD	71.7	43.7	51.0	55.5
Total PCDD	1195.7	1141.2	1093.4	1143.5
Furans				
2378 TCDF	5.7	4.5	6.5	5.6
Other TCDF	164.2	162.2	128.8	151.7
Penta CDF	71.4	74.1	76.6	74.0
Hexa CDF	44.3	59.0	53.0	52.1
Hepta CDF	37.5	27.7	23.7	29.6
Octa CDF	3.0	2.3	2.3	2.5
Total PCDF	326.1	329.8	290.9	315.5

6.0 SAMPLING LOCATIONS AND PROCEDURES

Samples were collected from six different locations at Site 07. Two of the locations were for gaseous sampling, and four were for solids sampling. The source sampling and analysis matrix in Table 4-1 lists the sample locations, measured parameters, sampling methods, and analytical methods used.

Details on the sampling location and methods are discussed in Sections 6.1 through 6.3. Continuous monitoring procedures for CO, CO_2, O_2, NO_x, and THC are included in Section 6.1.

6.1 GASEOUS SAMPLING

Four types of gaseous samples were taken during this test program: Modified Method 5 (MM5), HCl, EPA Method 3, and continuous emission monitoring (CEM). The sampling locations and methods are further discussed in this section.

6.1.1 Gaseous Sampling Locations

6.1.1.1 Baghouse Outlet. The baghouse outlet sampling location was shown as point A in Figure 4-1. This location was used for dioxin/furan sampling and HCl sampling according to MM5 procedures described in Section 6.1.2. Also, EPA Methods 2, 3, and 4 were performed to determine the volumetric flowrate, molecular weight of the exhaust gas, and moisture content of the exhaust gas, respectively.

The baghouse outlet sampling location is diagrammed in Figure 6-1. The internal size of the outlet duct is 59 inches by 72 inches. The six 4-inch ports are positioned in between the baghouse and the induced draft fan. The ports have a 6-inch flange and a 7-inch nipple.

The sample ports are 11 ft (2 equivalent diameters) downstream of a 90° bend and 16 ft (2.9 equivalent diameters) upstream of the entrance to the

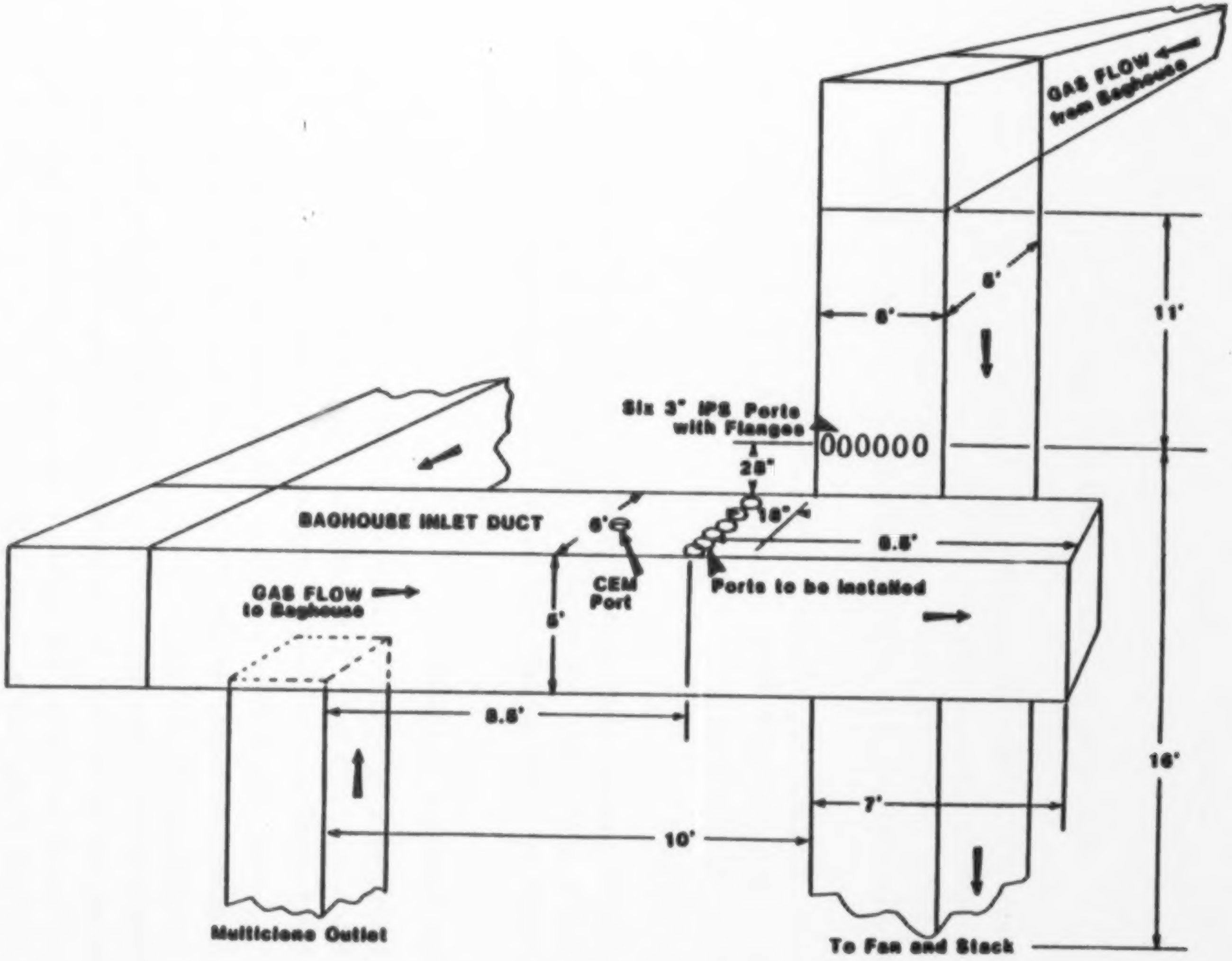

GAS FLOW from Baghouse
8'
6'
11'
16'
Six 3" IPS Ports with Flanges
000000
28"
18"
8.5'
BAGHOUSE INLET DUCT
6'
CEM Port
Ports to be Installed
GAS FLOW to Baghouse
5'
8.5'
7'
10'
Multiclone Outlet
To Fan and Stack

Figure 6-1. Sample Port Locations and Flow Dimensions.

induced draft fan. According to Method 1, a total of 24 traverse points are required. A 6 x 4 matrix, as illustrated in Figure 6-2, was used.

6.1.1.2 Baghouse Inlet (Boiler Outlet). The baghouse inlet sampling location was shown as point B in Figure 4-1. This location was used for dioxin/furan sampling according to MM5 procedures described in Section 4.2.2. EPA Methods 2, 3, and 4 were performed to determine the volumetric flowrate, molecular weight, and moisture content of the exhaust gas, respectively.

The baghouse inlet sampling locations are shown in Figure 6-1. The internal size of the duct was 60 inches by 72 inches. The ports are located on the inlet duct to the baghouse and are 2.2 equivalent diameters downstream of the gas entry from the multiclones, and 2.2 equivalent diameters upstream of the entrance to the baghouse. The ports have a six-inch flange and a 6½-inch nipple. The traverse points were a 6 x 8 grid for a total of 48 points, with identifications as shown in Figure 6-3.

A separate 3-inch port about 3 feet upstream of the MM5 sample location was used for CEM sampling.

6.1.2 Gas Sampling Procedures

Gas sampling procedures used during this program are discussed in detail in the Tier 4 Quality Assurance Project Plan (QAPP).[5] A summary of the gas sampling methods used at Site WFB-A is given in Table 6-1 and a brief description of each method is provided in the following sections.

6.1.2.1 Modified Method 5 (MM5). Gas sampling for dioxins was conducted according to the October 1984 draft of the ASME chlorinated organic compound sampling protocol. This sampling method is a modified version of EPA Method 5 that includes a solid sorbent module for trapping vapor phase organics. The only differences in the sampling protocol which were not discussed in the Tier 4 QAPP are:

(1) Benzene was substituted for hexane or toluene as both the clean-up and extracted solvent for both the MM5 filters and XAD-2 resin. This was caused by a discrepancy between the draft ASME sampling protocol and the draft ASME analytical protocol (November 16, 1985).

(2) Methylene chloride was substituted for hexane as the final field rinse solvent for the MM5 train. Methylene chloride was also substituted for

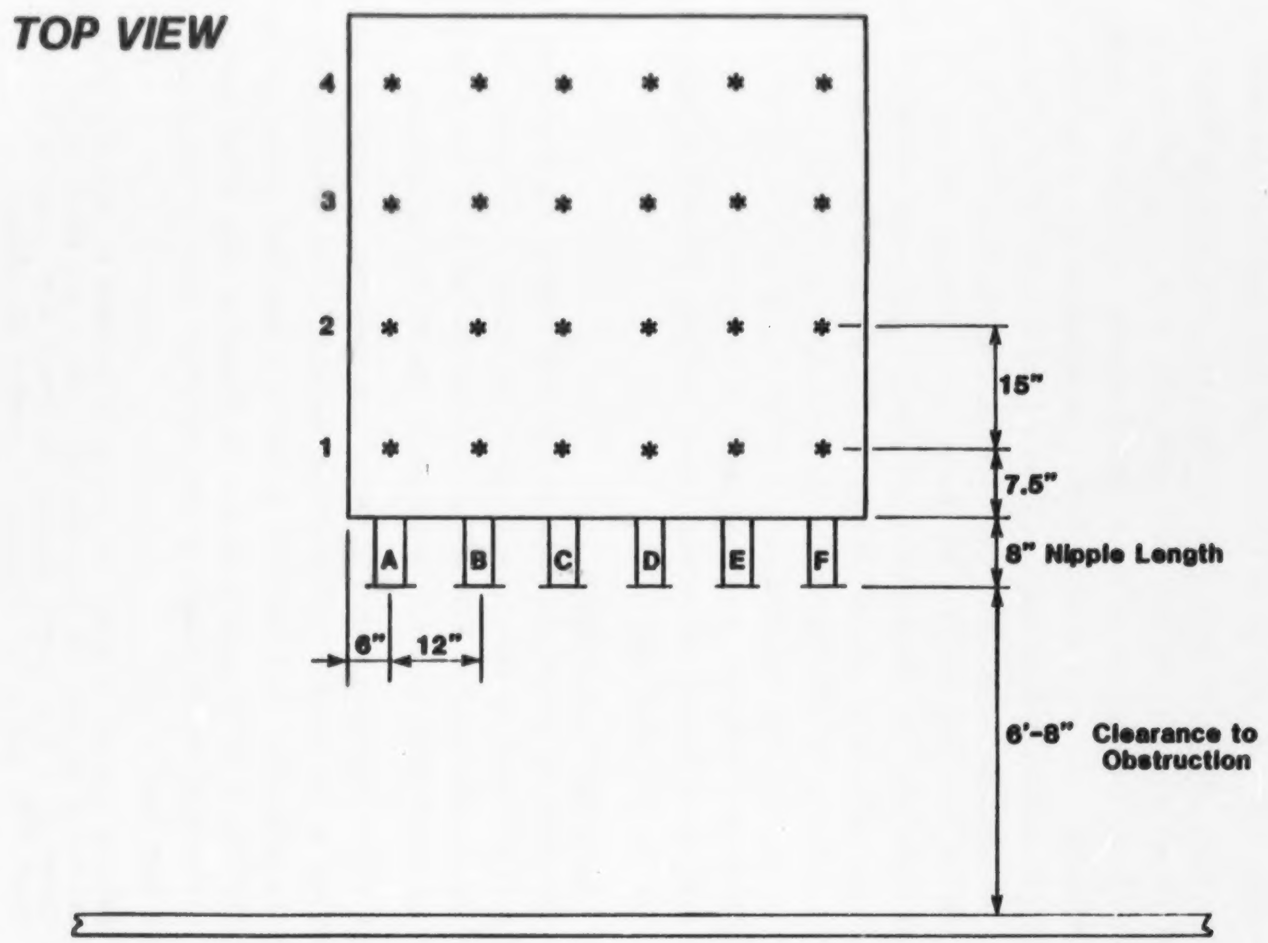

TOP VIEW
4
3
2
1
A
B
C
D
E
F
6"
12"
15"
7.5"
8" Nipple Length
6'-8" Clearance to Obstruction

Figure 6-2. Sample Point Layout: Baghouse Outlet

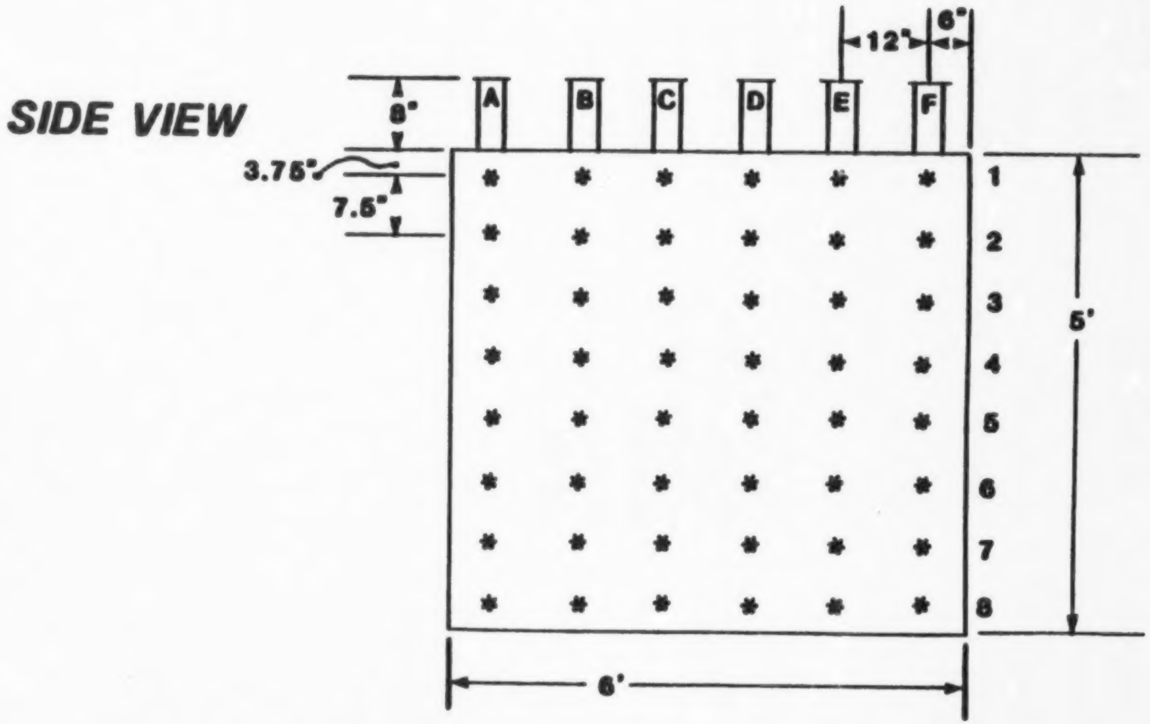

SIDE VIEW
A
B
C
D
E
F
12"
6"
8"
3.75"
7.5"
1
2
3
4
5
6
7
8
5'
6'

Figure 6-3. Sample Point Layout: Baghouse Inlet.

TABLE 6-1. SUMMARY OF GAS SAMPLING METHODS FOR SITE WFB-A

Sample Location	Sample Type or Parameter	Sample Collection Method
Baghouse Outlet (Point A on Figure 4-1)	Dioxin/Furan	Modified EPA Method 5
	Volumetric flow	EPA Method 2
	Molecular weight	EPA Method 3
	Moisture	EPA Method 4
	HCl	HCl train
Baghouse Inlet (Point B on Figure 4-1)	Dioxin/Furan	Modified EPA Method 5
	Volumetric flow	EPA Method 2
	Molecular weight	EPA Method 3
	Moisture	EPA Method 4
	CO, CO_2, O_2, NO_x and THC	Continuous monitors

hexane in the glassware cleaning procedure. This change was instituted to improve train clean-up efficiency.

The MM5 sampling train was used to collect samples at the baghouse outlet exhaust stack and baghouse inlet. A total of three MM5 test runs per location were conducted, with one test run being conducted per test day. The intent of the sampling at the baghouse inlet and outlet was to conduct isokinetic sampling at a rate of 0.5 scfm over a 4-hour sampling period to provide a minimum sample volume of 120 dscf. The isokinetic calculations are contained in Appendices A-2 to A-4. The sample volumes collected at the inlet and outlet were 120 dscf except for Runs 01 and 02 at the outlet which were slightly less at 117 dscf and 113 dscf, respectively. The field data sheets used in calculating the isokinetic values are contained in Appendices A-5 to A-7.

Following sample recovery, the various parts of the sample (filter, solvent rinses, sorbent trap, etc.) were sent to the EPA's Troika laboratories to quantify 2378-TCDD, the tetra- through octa-PCDD homologues, and the tetra- through octa-PCDF homologues present in the samples.

A schematic diagram of the MM5 sampling train is shown in Figure 6-4. Flue gas is pulled from the stack through a nozzle and a glass probe. Particulate matter is removed from the gas stream by means of a glass fiber filter housed in a teflon-sealed glass filter holder maintained at 248 ± 25°F. The gas passes through a sorbent trap similar to that illustrated in Figure 6-5 for removal of organic constituents. The trap consists of separate sections for: (1) cooling the gas stream, and (2) adsorbing the organic compounds on Amberlite XAD-2^R resin (XAD). A chilled impinger train following the sorbent trap is used to remove water from the flue gas, and a dry gas meter is used to measure the sample gas flow.

6.1.2.2 HCl Determination. The HCl concentrations in the outlet exhaust stack were determined using another modification of EPA Method 5. The sample train components and operation were identical to those of Method 5 with the following exceptions:

(1) Water in the first impingers was replaced with 0.1N KOH.

(2) Sampling was single point isokinetic with the nozzle placed at points in the stack with approximate average velocity.

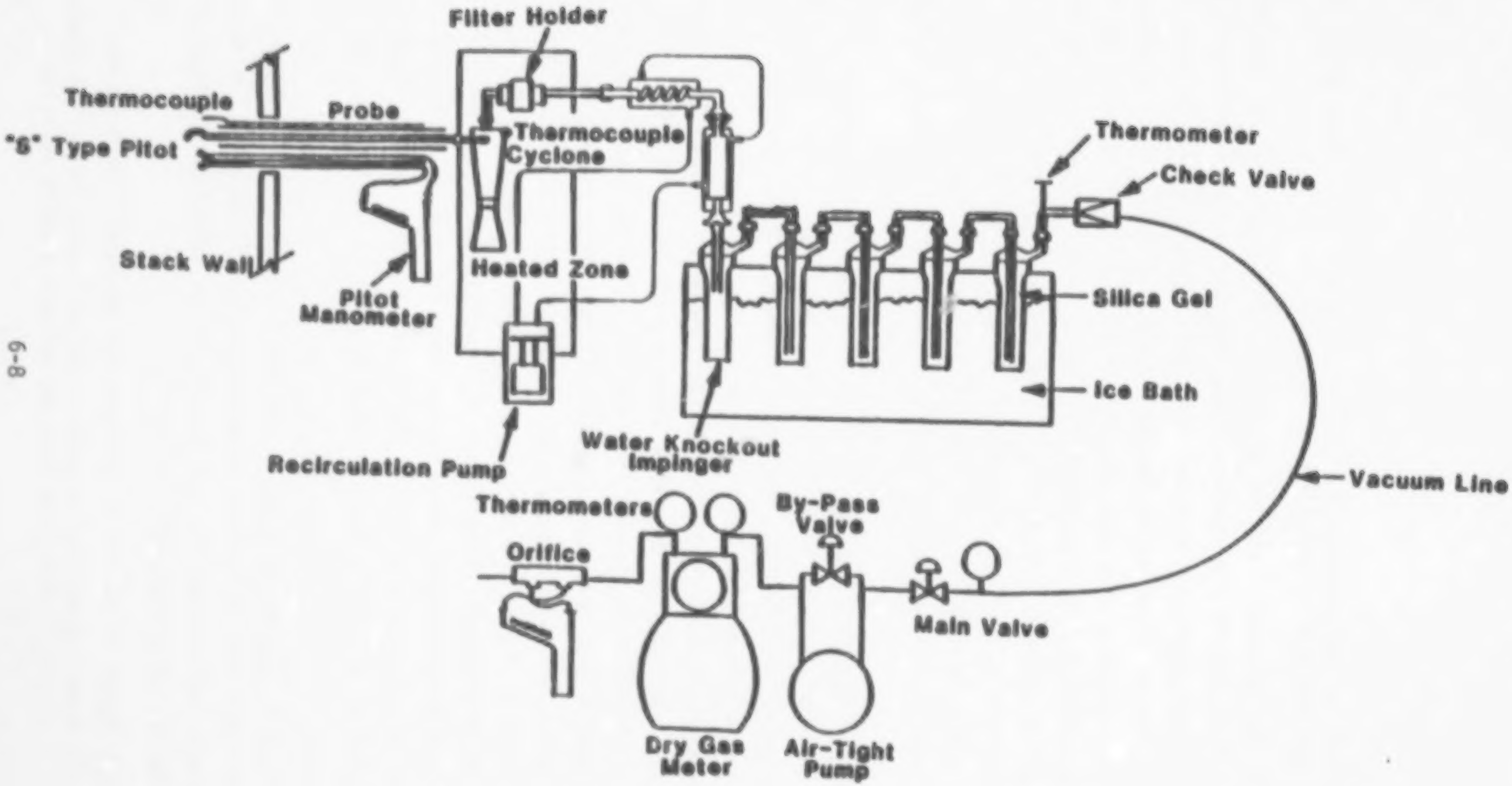

Filter Holder
Thermocouple
Probe
"S" Type Pitot
Thermocouple
Cyclone
Stack Wall
Pitot Manometer
Heated Zone
Recirculation Pump
Water Knockout Impinger
Thermometer
Check Valve
Silica Gel
Ice Bath
Vacuum Line
Thermometers
By-Pass Valve
Orifice
Main Valve
Dry Gas Meter
Air-Tight Pump

Figure 6-4. Modified Method 5 Train.

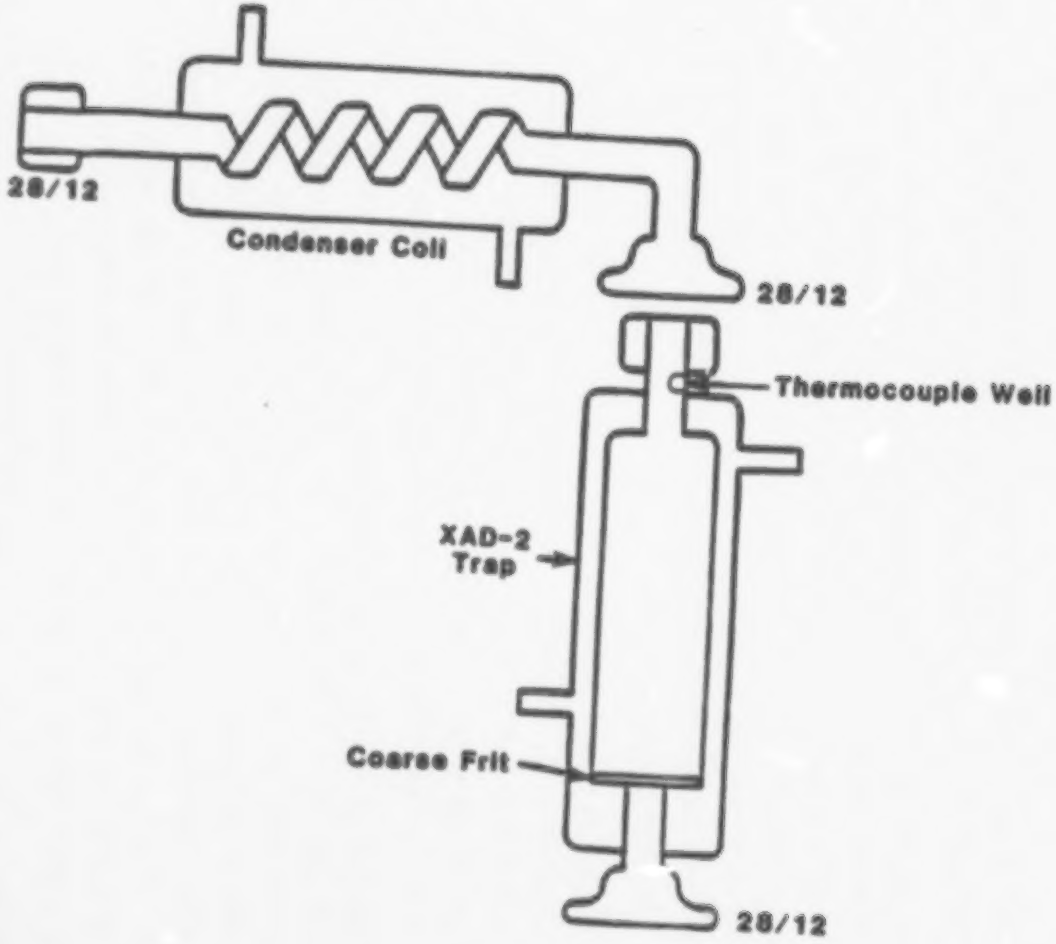

28/12
Condenser Coil
28/12
Thermocouple Well
XAD-2 Trap
Coarse Frit
28/12

Figure 6-5. Adsorbent Sampling System.

(3) The moisture/KOH in the impingers was saved for laboratory analysis by ion chromatography. The impinger catch was analyzed by Radian's Research Triangle Park, N. C., laboratory.

Recovery of the HCl train provides a sample consisting of three components: probe rinse, filter, and back-half rinse/impinger catch.

6.1.2.3 Volumetric Gas Flow Rate Determination. The volumetric gas flowrate was determined using EPA Method 2. Based on this method, the volumetric gas flow is determined by measuring the average velocity of the flue gas and the cross-sectional area of the duct. The average flue gas velocity is calculated from the average gas velocity pressure (ΔP) across an S-type pitot tube, the average flue gas temperature, the wet molecular weight, and the absolute static pressure.

6.1.2.4 Flue Gas Moisture Determination. The moisture content of the flue gas was determined using EPA Method 4. Based on this method, a known volume of particulate-free gas is pulled through a chilled impinger train. The quantity of condensed water is determined gravimetrically and then related to the volume of gas sample to determine the moisture content.

6.1.2.5 Flue Gas Molecular Weight Determination. The integrated sampling technique described in EPA Method 3 was used to obtain a composite flue gas sample for fixed gas (O_2, CO_2, N_2) analysis. The fixed gas analysis was used to determine the molecular weight of the gas stream. A small diaphragm pump and a stainless steel probe were used to extract single point flue gas samples. The samples were collected at the MM5 sampling ports using Tedlar^R bags. Moisture was removed from the gas sample by a water-cooled condenser so that the fixed gas analysis is on a dry basis.

6.2 SOLID SAMPLES

Solid samples of the wood fuel, baghouse dust, boiler bottom ash and soil were collected during each test.

6.2.1 Wood Feed Sampling

The wood feed was collected as grab samples and combined into four identical 500 g composite samples for each test run. One was archived for potential dioxin/furan analysis and the second and third were analyzed by Radian for dioxin precursors and total chlorides. The fourth sample was analyzed for heat content and moisture content.

6.2.2 Baghouse Dust Sampling

The baghouse dust was collected as grab samples and combined into two identical 500 g composite samples for each test run. One was analyzed by Troika for dioxin/furan and the second was analyzed by Radian for total chlorides. An additional 5 lb composite sample, a third of which was collected each test day, was sent to ERL-Duluth for bioassay testing.

6.2.3 Bottom Ash Sampling

Samples of bottom ash were collected from the primary and secondary combustion chamber ash pits. The primary chamber had three ash pits, one for each cell. A grab sample was collected daily from each primary ash pit and composited for each test run. To sample the primary ash pits, the underfire air for the chamber was turned off before opening the access door. A sample was also collected daily from the secondary combustion chamber ash pit for each test run. An additional 5 lb composite sample of all the bottom ashes, a third of which was collected each test day, was sent to ERL-Duluth for bioassay testing.

6.2.4 Soil Sampling

The final solid sample collected was a single composite soil sample comprised of 10 individual soil samples. Soil sampling protocol for Tiers 3, 5, 6, and 7 of the National Dioxin Study are specified in the document, "Sampling Guidance Manual for the National Dioxin Study". A similar protocol was used for soil sampling at Site WFB-A. A total of 10 soil sampling locations were selected according to the directed site selection approach described in the above document. The 10 individual soil sampling locations are shown in Figure 6-6. Soil samples were collected by forcing a bulb planter into the soil to a depth of 3 inches. The soil samples were composited in a clean stainless steel bucket. A portion of the composite were placed in a 1 liter glass bottle and archived at Radian for potential dioxin/furan analysis by Troika.

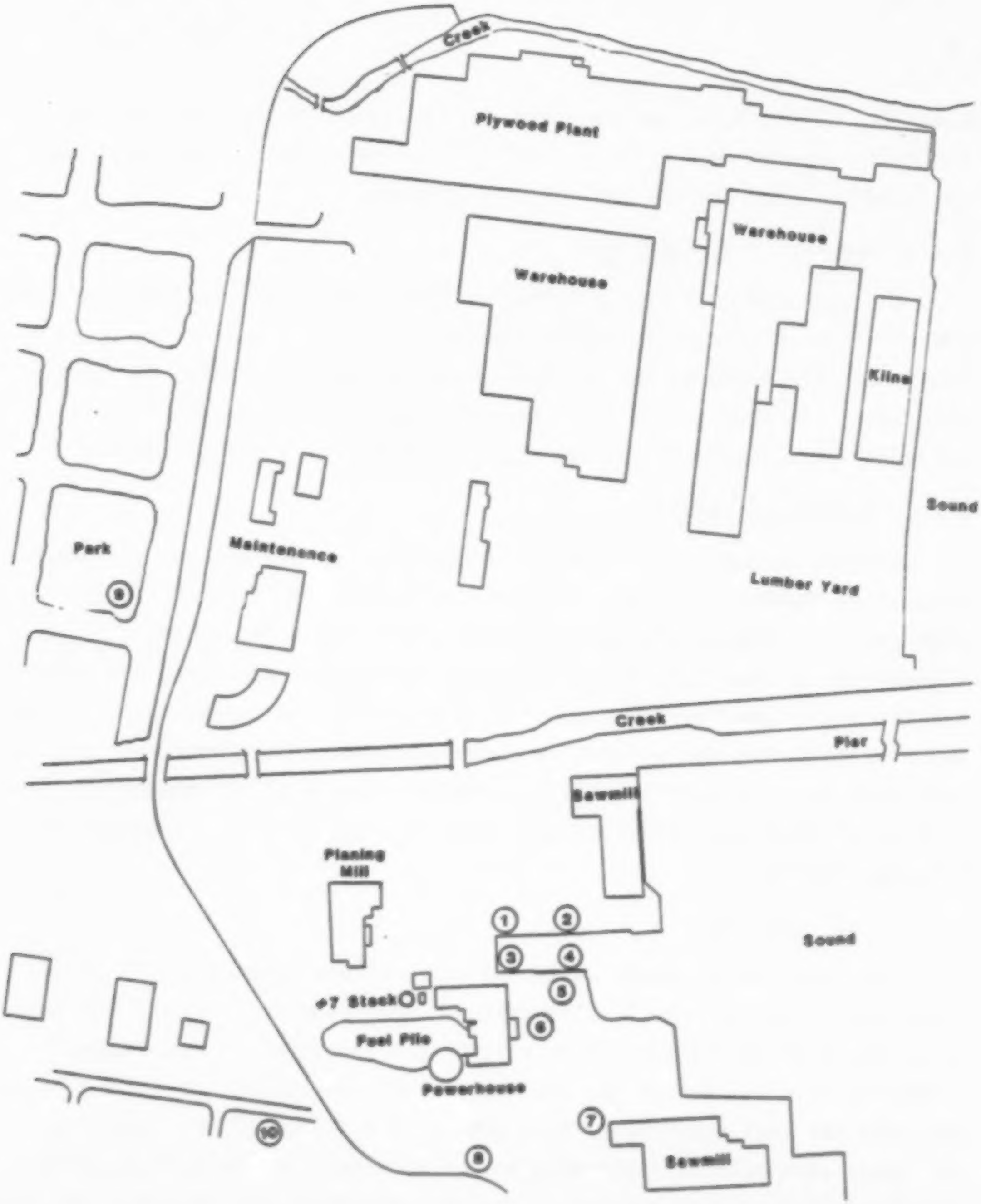

Creek
Plywood Plant
Warehouse
Warehouse
Kilns
Sound
Maintenance
Park
9
Lumber Yard
Creek
Pier
Sawmill
Planing Mill
1
2
3
4
Sound
5
#7 Stack
6
Fuel Pile
Powerhouse
7
10
8
Sawmill

Figure 6-6. Site Plot Plan and Soil Sampling Locations, Site 07.

7.0 ANALYTICAL PROCEDURES

Laboratory procedures used to quantify dioxins/furans and dioxin/furan precursors in the Tier 4 samples are described in this section. Samples analyzed by the EPA's Troika laboratories for dioxin/furan content included MM5 train samples and baghouse dust samples. Procedures used for the dioxin/furan analyses are described in detail in the Analytical Procedures and QA Plan for the Analysis of Tetra through Octa CDD's and CDF's in Samples from Tier 4 Combustion and Incineration Processes (addendum to EPA/600/3-85-019, April 1985). These procedures are summarized in Section 7.1. Wood feed samples were analyzed by Radian to determine concentrations of chlorinated phenols (CP), chlorobenzenes (CB), polychlorinated biphenyls (PCB's), total chlorides, and total organic halogen (TOX). Procedures used for these analyses are detailed in Section 7.2

7.1 DIOXINS/FURANS

The analytical procedures described in this section were used by ECL-BSL and EMSL-RTP for dioxin/furan analysis of MM5 train samples and baghouse dust samples from Site WFB-A. Samples consisting of organic solvents, aqueous solutions, and solids were prepared for analysis using slightly different procedures. The organic solvent samples consisted of rinses from the MM5 probe, nozzle, filter housing, and condenser coil. Aqueous samples consisted of impinger catch solutions; solid samples included filters, XAD resin, and baghouse dust. Isotopically-labeled surrogate compounds were added to all samples prior to extraction to allow determination of method efficiency.

Organic liquid samples (e.g., acetone and methylene chloride-based MM5 train rinses) were concentrated using a nitrogen blowdown apparatus. The residue, which contained particulate matter from the MM5 train probe and nozzle, was combined with the filter and handled as a solid sample. Solid samples were extracted with benzene in a Soxhlet apparatus for a period of at least 16 hours. The extract was concentrated by nitrogen blowdown and subjected to chromatographic cleanup procedures.

Aqueous solutions such as the MM5 train impinger samples were extracted with hexane by vigorous shaking for a 3-hour period. This extraction procedure was repeated three times, with the organic fractions ultimately being combined and concentrated for chromatographic cleanup.

The cleanup procedure involved using liquid chromatographic columns to separate the compounds of interest from other compounds present in the samples. Four different types of columns were used: a combination acid and base modified silica gel column, a basic alumina column, a PX-21 carbon/celite 545 column, and a silica/diol micro column. These were used in successive steps, with the last two being used only if necessary.

The cleaned samples were analyzed using high resolution gas chromatography/high resolution mass spectrometry (GC/MS). The conditions for analysis were as follows:

Gas Chromatograph - Injector configured for capillary column, splitless injection, injector temperature 280°C, helium carrier gas at 1.2 ml/min initial column temperature 100°C, final column temperature 240°C, interface temperature 270°C.

Mass Spectrometer - Varian/MAT Model 311A, electron energy 70ev, filament emission 1MA, mass resolution 8,000 to 10,000, ion source temperature 270°C.

7.2 DIOXIN/FURAN PRECURSORS

Feed samples for Site WFB-A were analyzed by Radian/RTP for CP, CB, PCB's by GC/MS, and TOX by GC/Hall detector. Analytical procedures are discussed in the following sections.

7.2.1 GC/MS Analyses

The analytical procedures used for determining CP, CB, and PCB concentrations in feed samples are modified versions of procedures typically used for the analysis of MM5 train components. These procedures involve initial extraction of the sample with an appropriate solvent, preliminary separation of the compounds of interest by solvent partitioning and liquid chromatography, and analysis of the processed fractions. Solutions containing CB and PCB are injected directly into the GC/MS, and solutions containing CP are derivatized prior to injection. Details on the procedures used for Site WFB-A samples are provided in the sections below.

7.2.1.1 Sample Preparation. A flow chart for the sample preparation procedure used for Site WFB-A feed samples is shown in Figure 7-1. The first step in the procedure involved adding labeled surrogate compounds to provide a measure of extraction method efficiency. The next step involved adding a mixture of 0.5 N NaOH and $MeCl_2$ to the sample and sonicating the sample for 30 minutes. The NaOH and $MeCl_2$ mixture converts the acid compounds to their salts and collects base/neutrals in the organic solvent. The sonicated sample was filtered and rinsed with 0.5 N NaOH. The filtrate was extracted three times in a separatory funnel with $MeCl_2$ and the aqueous and organic fractions were saved for derivatization and/or further cleanup. The aqueous fraction (or acids portion) was acidified to pH2 with HCl and then extracted three times with $MeCl_2$. The $MeCl_2$ from this extraction was dried with anhydrous Na_2SO_4, exchanged to benzene, and concentrated using a nitrogen blowdown apparatus. Acetylation of any CP present in the sample involved the following steps:

1. 2.0 mL isooctane, 2.0 mL acetonitrile, 50 uL pyridine, and 20 uL acetic anhydride were added to the extract. The test tube containing the extract was placed in a 60°C water bath for 15 minutes and was shaken 30 seconds every 2 minutes.
2. 6 mL of 0.01 N H_3PO_4 were added to the test tube, and the sample was agitated for 2 minutes on a wrist action shaker.
3. The organic layer was removed and the quantitation standard was added. The sample was concentrated in a Reacti-Vial at room temperature (using prepurified N_2) to 1 mL prior to GC/MS analysis.

Cleanup of the organic (or base/neutrals) layers from the first $MeCl_2$ extraction involved successively washing the extract with concentrated H_2SO_4 and double-distilled water. The acid or water was added in a 30 mL portion and the sample was shaken for 2 minutes. After the aqueous (or acid) and

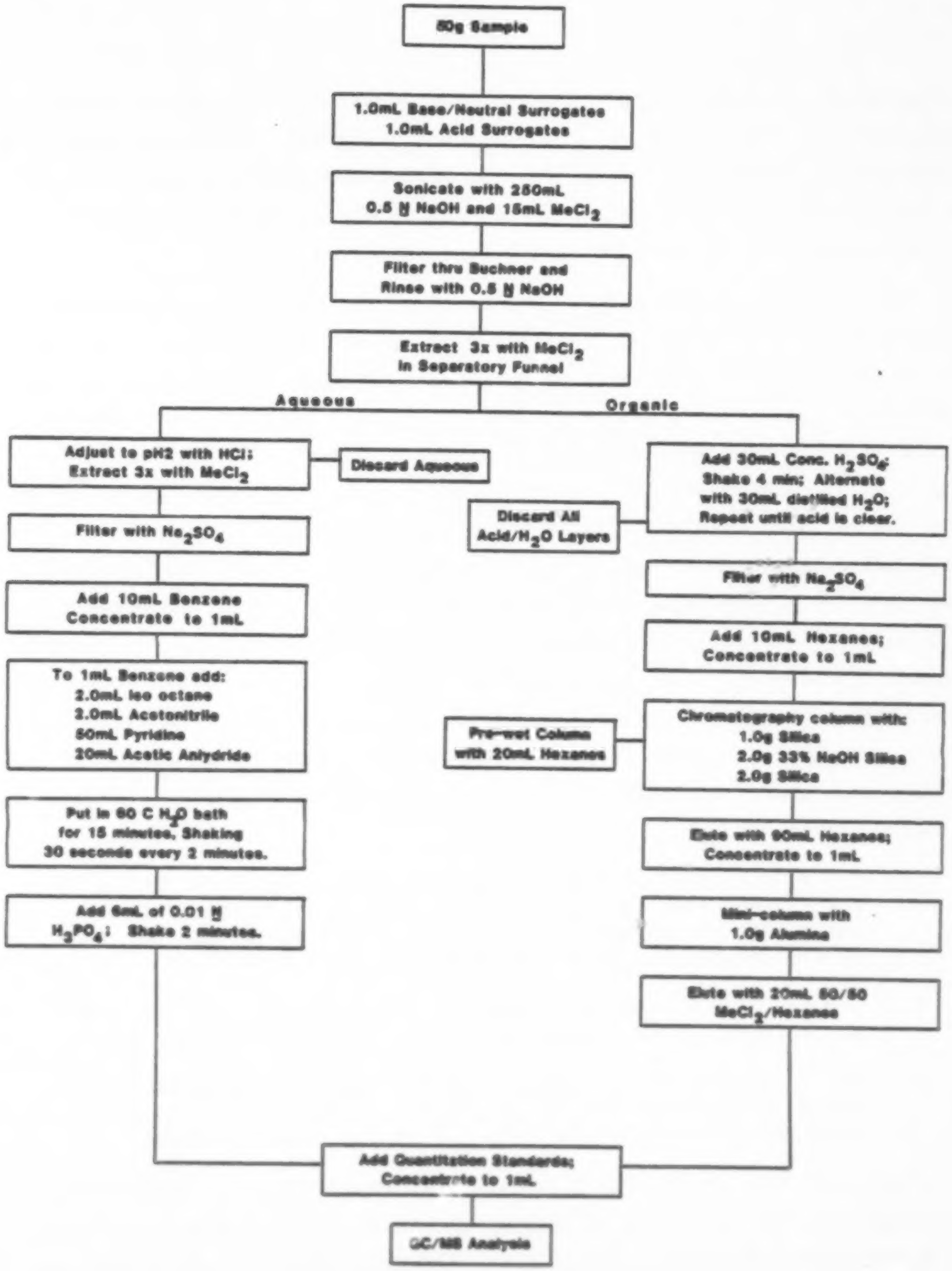

50g Sample
1.0mL Base/Neutral Surrogates
1.0mL Acid Surrogates
Sonicate with 250mL
0.5 N NaOH and 15mL $MeCl_2$
Filter thru Buchner and
Rinse with 0.5 N NaOH
Extract 3x with $MeCl_2$
in Seperatory Funnel
Aqueous
Organic
Adjust to pH2 with HCl:
Extract 3x with $MeCl_2$
Discard Aqueous
Filter with Na_2SO_4
Add 10mL Benzene
Concentrate to 1mL
To 1mL Benzene add:
2.0mL Iso octane
2.0mL Acetonitrile
50mL Pyridine
20mL Acetic Anhydride
Put in 60 C H_2O bath
for 15 minutes, Shaking
30 seconds every 2 minutes.
Add 6mL of 0.01 N
H_3PO_4: Shake 2 minutes.
Add 30mL Conc. H_2SO_4;
Shake 4 min; Alternate
with 30mL distilled H_2O;
Repeat until acid is clear.
Discard All
Acid/H_2O Layers
Filter with Na_2SO_4
Add 10mL Hexanes;
Concentrate to 1mL
Pre-wet Column
with 20mL Hexanes
Chromatography column with:
1.0g Silica
2.0g 33% NaOH Silica
2.0g Silica
Elute with 90mL Hexanes;
Concentrate to 1mL
Mini-column with
1.0g Alumina
Elute with 20mL 50/50
$MeCl_2$/Hexanes
Add Quantitation Standards;
Concentrate to 1mL
GC/MS Analysis

Figure 7-1. Sample Preparation Flow Diagram for Site WFB-A Precursor Analyses.

organic layers were completely separated, the aqueous (or acid) layer was discarded. The acid washing procedure was repeated until the acid layer was colorless. The organic fraction from the final wash was dried with anhydrous Na_2SO_4, exchanged to hexane and concentrated. Final cleanup of the sample by column chromatography involved the following procedure.

A glass macro-column, 20 mm o.d. x 230 mm in length, tapered to 6 mm o.d. on one end was prepared. The column was packed with a plug of silanized glass wool, followed successively by 1.0 g silica, 2.0 g silica containing 33 percent (w/w) 1 N NaOH, and 2.0 g silica. The concentrated extract was quantitatively transferred to the column and eluted with 90 mL hexane. The entire eluate was collected and concentrated to a volume of 1 mL in a centrifuge tube.

A disposable liquid chromatography min-column was constructed by cutting off a 5-mL Pyrex disposable pipette at the 2.0 mL mark and packing the lower portion of the tube with a small plug of silanized glass wool, followed by 1 g of Woehlm basic alumina. The alumina had been previously activated for at least 16 hours at 600°C in a muffle furnace and cooled in a desiccator for 30 minutes just before use. The concentrated eluate from above was quantitatively transferred onto the liquid chromatography column. The centrifuge tube was rinsed consecutively with two 0.3 mL portions of a 3 percent $MeCl_2$:hexane solution, and the rinses were transferred to the liquid chromatography column.

The liquid chromatography column was eluted with 20 mL of a 50 percent (v/v) $MeCl_2$:hexane solution, and the eluate was concentrated to a volume of approximately 1 mL by heating the tubes in a water bath while passing a stream of prepurified N_2 over the solutions. The quantitation standard was added and the final volume was adjusted to 1.0 mL prior to GC/MS analysis.

7.2.1.2 Analyses. Analyses for CP, CB, and PCB's present in the feed sample extracts were performed with a Finnigan Model 5100 mass spectrometer using selected ion monitoring. A fused silica capillary column was used for chromatographic separation of the compounds of interest. Analytical conditions for the GC/MS analysis are shown in Table 7-1.

TABLE 7-1. INSTRUMENT CONDITIONS FOR GC/MS PRECURSOR ANALYSES

Parameter	Chlorobenzenes/ Polychlorinated biphenyls	Chlorophenols
Column	30 m WB DB-5 (1.0 u film thickness) fused silica capillary	
Injector Temperature	290°C	290°C
Separator Oven Temperature	290°C	290°C
Column Head Pressure	9 psi	9 psi
He flow rate	1 mL/min	1 mL/min
GC program	40(4)-290°C, 10°/min & hold	40(1)-290°C, 12°/min & hold
Emission Current	0.50 ma	0.50 ma
Electron Energy	70 ev	70 ev
Injection Mode	Splitless 0.6 min, then 10:1 split	
Mode	Electron ionization, Selected Ion Monitoring	

Tuning of the GC/MS was performed daily as specified in the Tier 4 Quality Assurance Project Plan. An internal-standard calibration procedure was used for sample quantitation. Compounds of interest were calibrated against a fixed concentration of either d_{12}-chrysene (for CO) or d_8-naphthalene (for CB, PCB). Components of the calibration solution are shown in Table 7-2. For multi-point calibrations, this solution was injected at levels of 10, 50, 100, and 150 ng/mL.

The instrument detection limit for the analytes of interest (i.e., CP, CB, and PCB) was estimated to be approximately 500 pg on column. For a 50 g sample and 100 percent recovery of the analyte, this corresponds to a feed sample detection limit of 10 ppb.

7.3 TOX ANALYSIS

Wood feed samples were analyzed for total organic halide (TOX) by short-column GC and a Hall detector (GC/Hall). Solid samples were extracted with benzene for at least 16 hours in a Soxhlet apparatus. The extracts were washed three times with 100 mL portions of reagent-grade water concentrated to 10 mL.

An attempt to use a fused silica capillary column to separate surrogates from target compounds was unsuccessful due to the complexity of the sample constituents. Determinations for TOX were therefore performed on samples without surrogates and no measure of extraction efficiency is available.

Instrument conditions are shown in Table 7-3. Sample quantitation was based on an average response factor developed from a mixture of chlorinated benzenes and brominated biphenyls. Individual CP, CB, and PCB's were also injected at various concentrations to develop a calibration curve for comparison to the mixture response factors.

7.4 TOTAL CHLORINE ANALYSIS

Total chlorine concentrations in feed samples were determined by Parr Bomb combustion followed by ion chromatography (IC). An 0.5 g sample was placed in the Parr Bomb with 10 mL of a 50 g/L Na_2CO_3 solution. After combustion of the samples according to standard procedures (ASTM 2015), the contents of the bomb were rinsed into a 100 mL flask and diluted to 100 mL.

TABLE 7-2. COMPONENTS OF THE CALIBRATION SOLUTION

Base/Neutrals

4-chlorobiphenyl
3,3'-dichlorobiphenyl
2,4',5-trichlorobiphenyl
3,3'4,4'-tetrachlorobiphenyl
2,2',6,6'-tetrachlorobiphenyl
2,2,4,5,6-pentachlorobiphenyl
2,2',4,4',5,5'-hexachlorobiphenyl
2,2',3,4,4',5',6-heptachlorobiphenyl
2,2',3,3',4,4',5,5'-octachlorobiphenyl
2,2',3,3',4,4',5,6,6'-nonachlorobiphenyl
decachlorobiphenyl
p-dichlorobenzene
1,2,4-trichlorobenzene
1,2,3,5-tetrachlorobenzene
pentachlorobenzene
hexachlorobenzene
d_4-1,4-dichlorobenzene (SS)[1]
3-bromobiphenyl (SS)
2,2'.5,5'-tetrabromobiphenyl (SS)
2,2',4,4',6,6'-hexabromobiphenyl (SS)
octachloronaphthalene (QS)[2]
d_{10}-phenanthrene (QS)
d_{12}-chrysene (QS)

Acids

2,5-dichlorophenol
2,3-dichlorophenol
2,6-dichlorophenol
3,5-dichlorophenol
3,4-dichlorophenol
2,3,5-trichlorophenol
2,3,6-trichlorophenol
3,4,5-trichlorophenol
2,4,5-trichlorophenol
2,3,4-trichlorophenol
2,3,5,6-tetrachlorophenol
pentachlorophenol
d_6-phenol (SS)
d_4-2-chlorophenol (SS)
$^{13}C_6$-pentachlorophenol (SS)
d_8-naphthalene (QS)
2,4,6-tribromophenol (QS)
d_{10}-phenanthrene (QS)
d_{12}chrysene (QS)

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[1] Surrogate standard.

[2] Quantitation standard.

TABLE 7-3. ANALYTICAL CONDITIONS FOR TOX ANALYSIS

Hall Detector Conditions	
	Reactor temperature - 850°C
	Solvent - n-propanol
	Hydrogen flow rate - 35 mL/min
GC Conditions (Varian 3700)	
	Injection volume (1 - 5 uL)
	Helium carrier gas flow rate - 60 mL/min
	Column - 3-ft packed column with 1 in 10% OV 101
	Column temperature - 200°C isothermal

The resulting solution was analyzed for chloride concentration (Cl^-) by IC using standard anion conditions. For samples difficult to combust (such as sludges), 25 drops of paraffin oils were added to the bomb prior to combustion.

8.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This section summarizes the results of the quality assurance and quality control (QA/QC) activities for Site 07. The flue gas and ash dioxin/furan data for this site were generally within the QC specifications presented in the Tier 4 QAPP. All of the surrogate recoveries for labeled TCDD's were within the specified limits of 50 to 120 percent. Run 01 (baghouse inlet sample) was the only run having surrogate recoveries outside the QC limits of 40 to 120 percent for hepta- and octa-CDD's. Comparison of the measured and spiked values for the fortified laboratory QC samples were all within 25 percent of the true value for all target species except the hexa-CDF and hepta-CDF homologues. The measured values of these species were 38 percent higher and 31 percent lower, respectively, than the spiked value. However, these data still indicate that the dioxin/furan results are within accuracy criteria of ±50 percent specified for Tier 4.

The dioxin/furan precursor analysis of the feed samples was not as accurate as the dioxin/furan homologue analysis. Surrogate recoveries varied considerably for specific surrogate species, but were fairly uniform between runs for the same species. In spite of some of the low surrogate recoveries for some of the feed samples, the resulting analytical sensitivity for the target analytes was considered acceptable for the purpose of the study.

The following sections summarize the results of all Site 07 QA/QC activities. Manual gas sampling methods are considered in Section 8.1 and continuous emission monitoring and molecular weight determinations are considered in Section 8.2. Validation of the O_2 and CO_2 data is discussed in Section 8.3 and the laboratory analysis QA/QC activities are summarized in Section 8.4.

8.1 MANUAL GAS SAMPLING

Manual gas sampling methods at Site 07 included Modified Method 5 (MM5), HCl, and EPA Methods 1 through 4. These methods are discussed in Section 6.0. The QA/QC activities for the manual sampling methods centered around (1) equipment calibration, (2) glassware pre-cleaning, (3) procedural QC checks, and (4) sample custody procedures. An internal systems audit was performed using the preformatted quality control checklists contained in the Tier 4 QA/QC Plan. There were no deviations from the procedural specifications required by the test methods during the audit. The completed checklists are contained in Appendix C. Key activities and QC results in each of these areas are discussed in this section. Also discussed are problems encountered that may have affected data quality.

8.1.1 Equipment Calibration and Glassware Preparation

Pre-test calibrations or inspections were conducted on pitot tubes, sampling nozzles, temperature sensors and analytical balances. The meter calibration data are contained in Appendix A-13. Both pre-test and post-test calibrations were performed on the dry gas meters. All of the field test equipment met the calibration criteria specified in the Tier 4 Quality Assurance Project Plan (QAPP). Differences in the pre-test and post-test dry gas meter calibrations were less than 2 percent.

An extensive pre-cleaning procedure was used for all sample train glassware and sample containers. This cleaning procedure, which is outlined in Table 8-1, was implemented to minimize the potential for sample contamination with substances that could interfere with the dioxin/furan analysis. To minimize the potential for contamination in the field, all sample train glassware was capped with foil prior to use and stored in a dust controlled environment. Sample train assembly and recovery was performed on site in the laboratory trailer.

Procedural QC activities during the manual gas sampling focused on:

- visual equipment inspections,
- utilization of sample train blanks,

TABLE 8-1. GLASSWARE PRECLEANING PROCEDURE

NOTE: USE DISPOSABLE GLOVES AND ADEQUATE VENTILATION

1. Soak all glassware in hot soapy water (Alconox^R) 50°C or higher.
2. Distilled/deionized H_2O rinse (X3).[a]
3. Chromerge^R rinse if glass, otherwise skip to 6.
4. High purity liquid chromatography grade H_2O rinse (X3).
5. Acetone rinse (X3), (pesticide grade).
6. Methylene chloride rinse (X3), (pesticide grade).
7. Cap glassware with clean glass plugs or methylene chloride rinsed aluminum foils.

---

[a] (X3) = three times.

- ensuring the proper location and number of traverse points,
- conducting pre-test and post-test sample train leak checks,
- maintaining proper temperature at the filter housing, sorbent trap and impinger train,
- maintaining isokinetic sampling rates, and
- recording all data on preformatted field data sheets.

There were no major problems encountered during the testing. The minor problems were corrected and will not affect the outcome of the test runs. The problems encountered and the resolutions are:

Test No.	Problem	Resolution
07-HCL-BO-3	The filter box heater stopped.	Replaced the filter box.
07-MM5-BO-3	A "U" tube broke during a port change.	Replaced the "U" tube.
	The probe liner heater shorted out.	Replaced the probe liner.

Results of the isokinetic calculations for the MM5 and HCl test runs are shown in Table 8-2. The average isokinetic sampling rate for all sampling runs except HCl-2 was within the QA objective of 100 ± 10 percent. The HCl-2 at 111.5 percent of isokinetic is close enough to the desired value not to cause any significant deviation in the sampling results.

A blank sample train was used at the MM5 sample locations to determine the background levels of contaminants that might interfere with dioxin and furan analysis. The blank sample trains were treated as normal sample trains. The trains were transported to and assembled at the sample locations. Recovery was performed in the same sequence as a normal test run. All solvents used in the recovery of blanks came from the same container as was used for normal test runs.

Initial, final and port change leak checks for the MM5 and HCl sample trains were acceptable for all of the test runs. None of the reported sample volumes required correction for sample train leakage. All leak check data are noted on the MM5 and HCl field data sheets.

TABLE 8-2. SUMMARY OF ISOKINETIC RESULTS FOR MM5

Run	MM5 Outlet	Meets Objective[a]	HCl Outlet	Meets QC Objective	MM5 Inlet	Meets QC Objective
01	99.7	Yes	106.4	Yes	104.8	Yes
02	105.1	Yes	111.5	No	107.2	Yes
03	101.7	Yes	104.6	Yes	106.3	Yes

[a] The quality assurance objective for MM5 and HCl sampling was isokinetics of 100±10 percent.

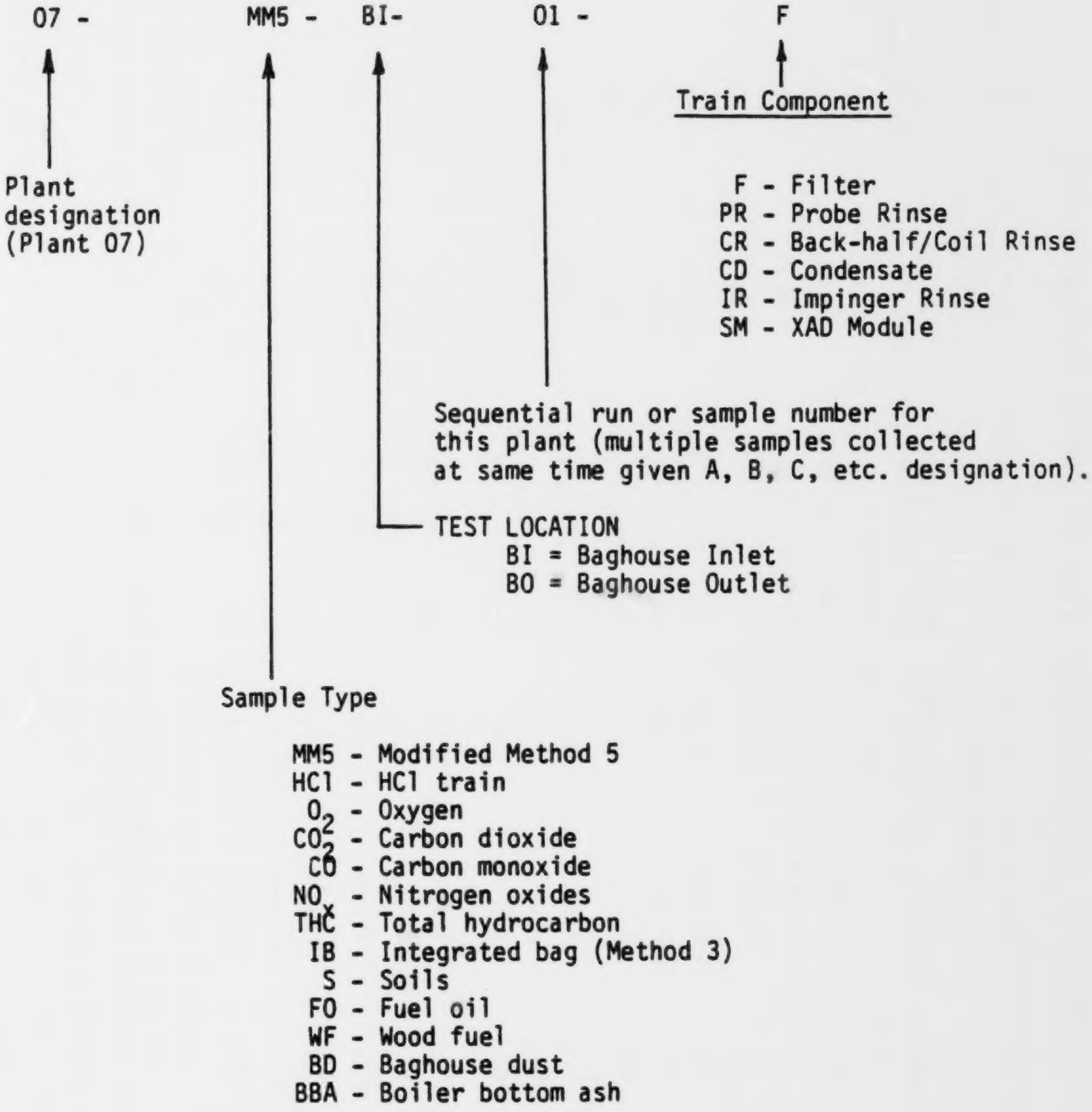
Sample custody procedures used during this program emphasized careful documentation of the samples collected and the use of chain-of-custody records for samples transported to the laboratory for analysis. Steps taken to identify and document samples collected included labeling each sample with a unique alphanumeric code shown in Figure 8-1 and logging the sample in a master logbook. All samples shipped to Troika or returned to Radian/RTP were also logged on chain-of-custody records that were signed by the field sample custodian upon shipment and also signed upon receipt at the laboratory. The samples were shipped to Troika from the field. A sample shipment letter was sent with the samples detailing their analysis priority which is contained in Appendix H. Each sample container lid was individually sealed to ensure that samples were not tampered with. No evidence of loss of sample integrity was reported for samples collected at this site.

8.2 CONTINUOUS MONITORING/MOLECULAR WEIGHT DETERMINATION

Flue gas parameters measured continuously at the inlet location during the MM5 test runs include CO, CO_2, O_2, total hydrocarbons (THC) and NO_x. The concentration of O_2, CO_2, and nitrogen (N_2) were also determined for integrated bag samples of the flue gas. Quality control results for these analyses are discussed in this section.

Drift check results for the continuously monitored flue gas parameters are summarized in Table 8-3. Data reduction was performed by assuming a linear drift of the instrument response over the test day based on drift checks at the beginning and end of the day. The largest calibration drifts were observed for the THC analyzer, which exceeded QC target goals for 1 test run. The smallest instrument drift was observed in the oxygen monitor.

The quality control standards for this program consisted of mid-range concentration standards that were intended for QC purposes and not for instrument calibration. The QC gases were analyzed immediately after calibration each day to provide data on day-to-day instrument variability. The



07 - MM5 - BI- 01 - F

Plant designation (Plant 07)

Sample Type

MM5 - Modified Method 5
HCl - HCl train
O_2 - Oxygen
CO_2 - Carbon dioxide
CO - Carbon monoxide
NO_x - Nitrogen oxides
THC - Total hydrocarbon
IB - Integrated bag (Method 3)
S - Soils
FO - Fuel oil
WF - Wood fuel
BD - Baghouse dust
BBA - Boiler bottom ash

TEST LOCATION
BI = Baghouse Inlet
BO = Baghouse Outlet

Sequential run or sample number for this plant (multiple samples collected at same time given A, B, C, etc. designation).

Train Component

F - Filter
PR - Probe Rinse
CR - Back-half/Coil Rinse
CD - Condensate
IR - Impinger Rinse
SM - XAD Module

Figure 8-1. Alpha-numeric sampling code for Site WFB-A.

TABLE 8-3. SUMMARY OF DRIFT CHECK AND CONTROL STANDARD RESULTS.

			Drift Check			QC Standard			
Test Date	Test Run	Parameter	Input Concentration	Instrument Drift, %[a]	Meets QC?[b]	Input Concentration	Output Concentration	Difference From Running Mean, %	Meets QC?[c]
4/16/85	01	O_2	21.1% V	-0.15	Yes	9.3% V	9.6	--	Yes
4/17/85	02	O_2	21.1% V	0.10	Yes	9.3% V	9.4	-1.05	Yes
4/18/85	03	O_2	21.1% V	-0.24	Yes	9.3% V	9.7	1.39	Yes
4/16/85	01	CO	5580 ppmv	0.70	Yes	2006.0 ppmv	2160.0	--	Yes
4/17/85	02	CO	5580 ppmv	2.00	Yes	2006.0 ppmv	2272.9	2.50	Yes
4/18/85	03	CO	5580 ppmv	0.23	Yes	2006.0 ppmv	2445.3	-2.16	Yes
4/16/85	01	CO_2	18.0% V	4.30	Yes	13.0% V	12.70	--	Yes
4/17/85	02	CO_2	18.0% V	3.00	Yes	13.0% V	13.36	2.53	Yes
4/18/85	03	CO_2	18.0% V	7.00	Yes	13.0% V	12.65	-1.94	Yes
4/16/85	01	NO_x	1052 ppmv	6.60	Yes	155.0 ppmv	157.8	--	Yes
4/17/85	02	NO_x	1052 ppmv	5.00	Yes	155.0 ppmv	161.2	1.06	Yes
4/18/85	03	NO_x	1052 ppmv	1.53	Yes	155.0 ppmv	155.6	-1.64	Yes
4/16/85	01	THC	90 ppmv	0.60	Yes	90.0 ppmv	87.1	--	Yes
4/17/85	02	THC	90 ppmv	14.0	No	90.0 ppmv	--[d]	--[d]	--[d]
4/18/85	03	THC	90 ppmv	0.42	Yes	90.0 ppmv	--[d]	--[d]	--[d]

---

[a] Instrument drift is defined as the percent difference between the instrument drift response to the input concentration at the beginning and end of the test run.

[b] QC criteria was instrument drift within +/- 10 percent.

[c] QC criteria was output concentration within +/- 10 percent of the running mean concentration for this test site.

[d] Not available due to having no calibration gas at low range.

[e] No data available for Run 06 due to gas conditioner malfunction.

[f] No THC drift check data available for Run 01 due to blocked capillary.

acceptance criteria for the analysis of each QC standard was agreement within ±10 percent of the running mean value.

8.3 VALIDATION OF O_2 and CO_2 DATA

The oxygen and carbon monoxide data collected during the test are validated using the method described in Reference 6. In this method, the maximum percent of CO_2 possible in the flue gas is calculated assuming that all of the carbon is converted to CO_2 and based on the ultimate analysis of the fuel (carbon, hydrogen, sulfur, nitrogen, and oxygen content).

As shown in Figure 8-2, the test data is plotted on a graph of oxygen in flue gas versus carbon monoxide in flue gas. Both the CEM data and the fixed gas analysis data from EPA Method 3 are plotted in the figure. Then a line is drawn between the oxygen concentration in air (20.9 percent) and the maximum percent of CO_2 possible (20.09 percent in this case) with a 5 percent tolerance range.

As the figure indicates, the CEM data falls within the 5 percent tolerance and is considered valid. The EPA Method 3 data varies up to 40 percent from the expected values. However, the fixed gas analysis is only used to calculate molecular weights of flue gas for isokinetic sampling calculations. In these calculations, a variation of 40 percent in O_2 and CO_2 values has a small effect on the calculation of in molecular weight and has an insignificant effect on the final isokinetic results.

8.4 LABORATORY ANALYSES

The QA/QC activities were carried out for dioxin/furan, precursor, and total chloride analyses performed on Site WFB-A samples. The dioxin/furan analyses of MM5 train samples performed by Troika are considered in Section 8.4.1; the precursor analyses of wood feed samples performed by Radian/RTP are considered in Section 8.4.2; and the total chloride analyses of HCl train samples performed by Radian/Austin are reported in Section 8.4.3.

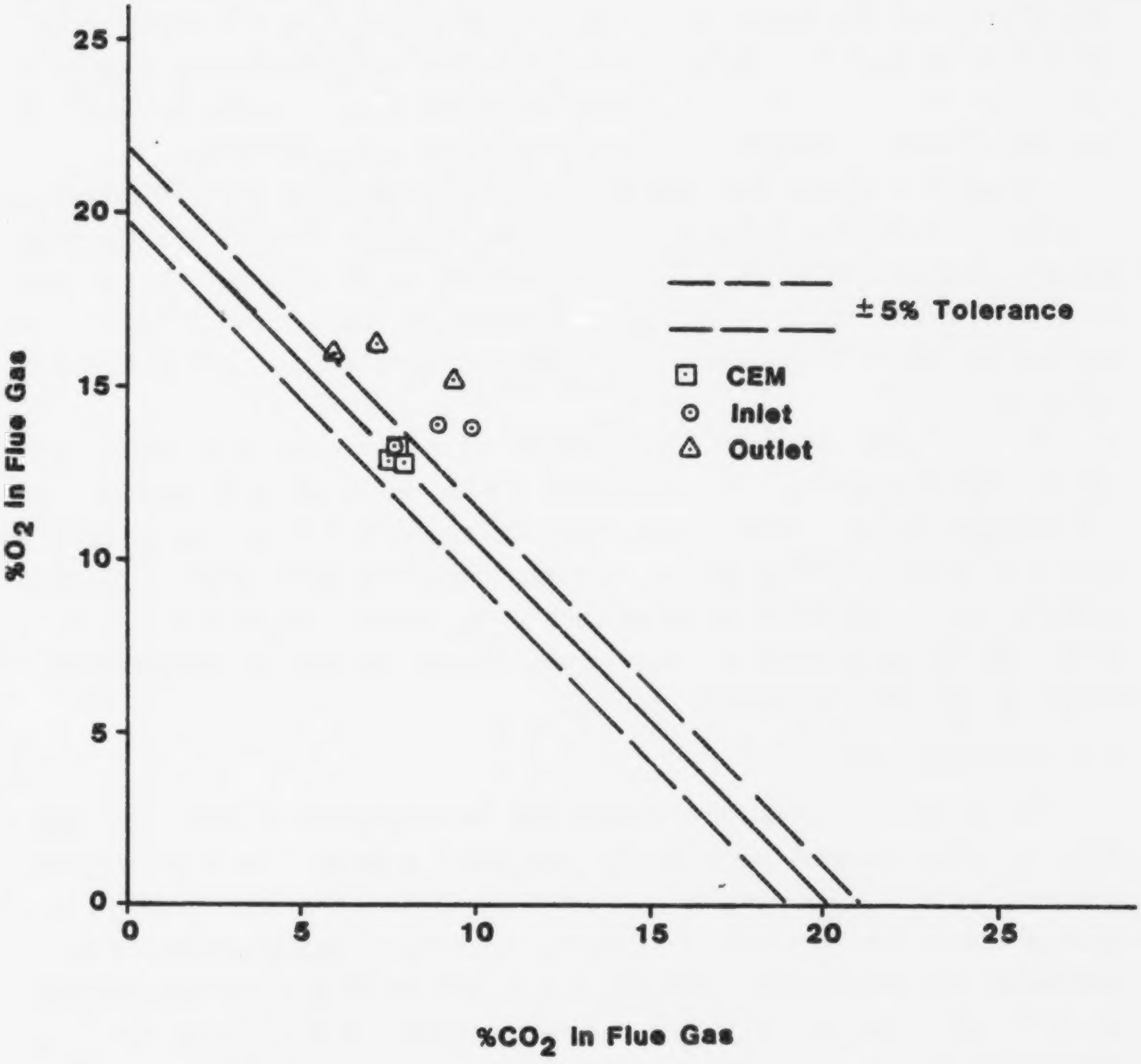


Figure 8-2. Validation of CEM and EPA Method 3 O_2 and CO_2 Data.

8.4.1 Dioxin/Furan Analyses

Two individual topics related to the dioxin/furan analyses at Site WFB-A are discussed in this section. Analytical recoveries of labeled surrogate compounds spiked onto MM5 train samples are reported in Section 8.4.1.1. Sample blank data are reported in Section 8.4.1.2.

8.4.1.1 Surrogate Recoveries of the Test Samples. Table 8-4 presents the analytical recovery data reported by Troika for four isotopically labeled surrogate compounds spiked onto the MM5 train samples. Samples were spiked with all four of the surrogates. Average recovery for the MM5 train samples was 64 percent for the inlet and 80 percent for the outlet. All values were in the target range except for the hepta- and octa-CDD's for Run 01 at the baghouse inlet. The recoveries were only 4 and 6 percent, respectively.

8.4.1.2 Sample Blanks. Table 8-5 summarizes the analytical results reported by Troika for internal laboratory blanks, laboratory fortified QC samples, and field recovery blank MM5 train samples. In general, the data showed good surrogate recoveries, with values ranging from 42 to 110 percent. Several dioxin/furan homologues were detected in the laboratory blank sample. They included octa-CDD, other TCDF, hepta-CDF, and octa-CDF in the quantities of 0.1, 0.04, 0.03, and 0.04 ng per sample train, respectively. Comparison of the measured and spiked values for the laboratory fortified QC samples showed agreement to within ± 25 percent for all target species except the hexa-CDF, and hepta-CDF homologues. The measured values of the hepta CDD/CDF homologue were 38 percent higher than the spiked value while the value for the hexa-CDF homologue was 31 percent lower than the spiked value. Small but detectable quantities of several dioxin and furan species were found in the field blank MM5 train. In the baghouse outlet sample 0.3 ng of other TCDD and TCDF was detected. Octa-CDD/CDF were detected in the inlet and outlet samples. In the inlet samples, 0.3 ng of octa-CDD and 0.2 ng of octa-CDF was found, while in the outlet samples 0.4 ng of octa-CDD and 0.1 ng of hepta CDF were detected at the inlet and outlet samples, respectively.

TABLE 8-4. SUMMARY OF SURROGATE RECOVERIES FOR DIOXIN/FURAN ANALYSES ON SITE WFB-A SAMPLES

Compound	Surrogate recoveries (percent)					
	Inlet			Outlet		
	Run 01 MM5	Run 02 MM5	Run 03 MM5	Run 01 MM5	Run 02 MM5	Run 03 MM5
$^{37}Cl_{4}$-TCDD	52	112	88	92	108	104
$^{13}C_{12}$-TCDD	52	106	88	96	112	114
$^{37}Cl_{4}$-Hepta-CDD	4	78	48	75	54	66
$^{13}Cl_{12}$-Octa-CDD	6	66	64	58	41	40

TABLE 8-5. ANALYSIS RESULTS FOR QUALITY CONTROL SAMPLES

	Flue Gas Quality Control Samples				
		Fortified Laboratory QC Sample		Field Blank MM5 Train	
Compound	Laboratory Blank	Measured Value	True Value^{a,b}	Inlet	Outlet
	Amount Detected (Nanograms per Sample)				
Dioxins					
2378 TCDD	ND	0.4	0.4 (0)	ND	ND
Other TCDD	ND	ND	ND (0)	ND	0.3
Penta CDD	ND	ND	ND (0)	ND	ND
Hexa CDD	ND	1.2	1.6 (-25)	ND	ND
Hepta CDD	ND	3.3	2.4 (38)	ND	ND
Octa CDD	0.1	3.7	3.2 (16)	0.3	0.4
Furans					
2378 TCDF	ND	0.5	0.4 (25)	ND	ND
Other TCDF	0.04	ND	ND (0)	ND	0.3
Penta CDF	ND	0.7	0.8 (-13)	ND	ND
Hexa CDF	ND	1.1	1.6 (-31)	ND	ND
Hepta CDF	0.03	3.3	2.4 (38)	0.2	0.1
Octa CDF	0.04	3.7	3.2 (16)	0.2	0.1
	Surrogate Recoveries (Percent)				
$^{37}\mathrm{Cl}_4$-TCDD	94	98	NA	63	98
$^{13}\mathrm{C}_{12}$-TCDD	108	110	NA	78	98
$^{37}\mathrm{Cl}_4$-Hepta CDD	61	42	NA	90	94
$^{13}\mathrm{C}_{12}$-Octa CDD	63	42	NA	92	98

---

[a] True values represent the amounts of each homologue spiked into the laboratory fortified QC samples.

[b] Value shown in parenthesis is the percentage difference between the measured and the true value:

$$\% = \frac{\text{Measured Value} - \text{True Value}}{\text{True Value}} \times 100$$

NR = not reported by Troika.
ND = Not detected.
NA = Not applicable.

Table 8-6 gives a comparison of the dioxin/furan analytical results for the field blank MM5 train and the test run MM5 trains. Several dioxin/furan homologues were detected in the blank MM5 train, however in most cases, the values were less than 5 percent of the minimum test run value. The only exception was the octa-CDF homologue where, at the inlet, 0.2 ng was detected in the blank MM5 sample train while none was detected in the test run MM5 trains. In addition, at the outlet, the field blank value was 17 percent of the minimum test run value. Overall, the field cleanup procedures were found to be adequate for this test site. Emissions data reported in Section 5.4 are not blank-corrected.

8.4.2 Precursor Analyses

Table 8-7 presents analytical recovery efficiencies for six isotopically labeled compounds used as surrogates for the target precursor analytes in the Site WFB-A feed samples. The surrogate recovery values in Table 8-7 vary considerably by specific surrogate species but are fairly uniform between runs for the same species. Several of the recoveries are below the 50 percent objective stated in the Tier 4 QA Project Plan and are below those generally considered achievable when analyzing for similar compounds in water or from MM5 train components. In spite of the relatively low surrogate recovery values for some of the feed samples, the resulting analytical sensitivity for the target analytes was considered acceptable for the purpose of this study.

8.4.3 Total Chloride Analyses

Total chloride analyses were performed by Radian/Austin on the HCl train samples. A blank HCl train sample was analyzed for comparison with the test samples. Only 1 mg/L of chloride was detected in each of the front-half and back-half samples, respectively.

TABLE 8-6. FIELD BLANK DIOXIN/FURAN DATA FOR SITE WFB-A MM5 SAMPLES

	Amount Detected, Nanograms per Train					
	Field Blank Value		Minimum Test Run Value		Percentage[a]	
Isomer/Homologue	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Dioxins						
2378 TCDD	ND	ND	1.1	0.2	0	0
Other TCDD	ND	0.3	16.5	23.0	0	1.3
Penta CDD	ND	ND	33.4	17.9	0	0
Hexa CDD	ND	ND	18.0	15.8	0	0
Hepta CDD	0.1	ND	22.9	30.2	0.4	0
Octa CDD	0.3	0.4	6.0	9.4	5.0	4.3
Furans						
2378 TCDF	ND	ND	8.0	1.3	0	0
Other TCDF	ND	0.2	100.0	22.2	0	1.4
Penta CDF	ND	ND	17.2	10.8	0	0
Hexa CDF	ND	0.2	11.9	3.1	0	0
Hepta CDF	0.2	0.1	4.8	3.2	4.2	3.1
Octa CDF	0.2	0.1	nd	0.6	--	16.7

[a] Percentage shown is the ratio of the field blank value to the minimum test run value, expressed as a percentage.

TABLE 8-7. PERCENT SURROGATE RECOVERIES FOR SITE WFB-A FEED SAMPLES

Surrogate Compound	Percent Surrogate Recovery			
	Wood Feed Samples			
	Run 1	Run 2[a]	Run 3[a]	Average
d_4-dichlorobenzene	16	41, ND	30, 20	21
bromobiphenyl	84	99, 79	46, 28	67
2', 5, 5' tetra bromobiphenyl	95	105, 91	53, 31	75
d_6-phenol	4	13, 10	15	11
d_4-2-chlorophenol	43	54, 47	14	40
$^{13}C_6$-pentachlorophenol	ND	17, 9	13	10

[a] Two values indicate duplicate analysis of same sample.

REFERENCES

1. Trip Report and Attachments. Herring, J., Acurex Corporation. July 6, 1979. Report of June 14, 1979 visit to Simpson Timber Company Sawmill, Shelton, Washington for Nonfossil-Fueled Boilers project.

2. Shigehera, R. T., et al. Stack Sampling Technical Information - A Collection of Monographs and Papers - Volume 1. OAQPS, U. S. EPA. October 1978. p. 40.

3. Junge, David C., (Oregon State University.) Design and Operation of Industrial Boilers Fired with Wood and Bark Residue Fuel. Prepared for U. S. Department of Energy. August 1982. p. 3.

4. Reference 3, pp. 127 - 151.

5. "National Dioxin Study Tier 4 - Combustion Sources, Quality Assurance Project Plan". Radian Corporation. EPA Contract No. 68-02-3148. Draft. December 10, 1984.

6. Reference 2, pp. 44 - 55.

APPENDICES

Appendix A Field Results
- A.1 Definition of Terms and Sample Calculation for MM5 Calculations
- A.2 Baghouse Inlet MM5 Calculations and Results
- A.3 Baghouse Outlet MM5 Calculations and Results
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- A.5 Baghouse Inlet MM5 Field Data Sheets
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Appendix B Process Monitoring Data

Appendix C System Audit Checklists

Appendix D CEM Data

Appendix E Wood Feed Heat Content Analysis

Appendix F Testing Personnel

Appendix G Error Analysis of Control Device Efficiency Calculations

Appendix H Sample Shipping Letter

Appendix I Dioxin/Furan Analytical Data for Gaseous Samples

Appendix J Run-specific Dioxin/Furan Emissions Data
- J.1 Run-specific Dioxin/Furan Emissions Data (As-measured Concentrations)
- J.2 Run-specific Dioxin/Furan Emission Data (Concentrations Corrected to 3 Percent Oxygen)

Appendix K Run-specific Risk modeling Input Data

Appendix L Compound-specific Precursor Results

APPENDIX A

FIELD RESULTS

A-1

CALCULATIONS - DEFINITIONS OF TERMS AND SAMPLE CALCULATION

RADIAN SOURCE TEST
EPA METHODS 2-5
DEFINITION OF TERMS

PARAMETER	DEFINITION
Tt(min.)	TOTAL SAMPLING TIME
Dn(in.)	SAMPLING NOZZLE DIAMETER
Ps(in.H2O)	ABSOLUTE STACK STATIC GAS PRESSURE
Vm(cu.ft.)	ABSOLUTE VOLUME OF GAS SAMPLE MEASURED BY DGM
Vw(gm.)	TOTAL STACK MOISTURE COLLECTED
Pm(in.H2O)	AVERAGE STATIC PRESSURE OF DGM
Tm(F)	AVERAGE TEMPERATURE OF DGM
Pb(in.Hg.)	BAROMETRIC PRESSURE
% CO2	CARBON DIOXIDE CONTENT OF STACK GAS
% O2	OXYGEN CONTENT OF STACK GAS
% N2	NITROGEN CONTENT OF STACK GAS
SQR(DELPS)	AVE. SQ. ROOT OF S-PITOT DIFF. PRESSURE-TEMP. PRODUC
As(sq.in.)	CROSS-SECTIONAL AREA OF STACK(DUCT)
Ts(F)	TEMPERATURE OF STACK
Vm(dscf)	STANDARD VOLUME OF GAS SAMPLED ,Vm(std),AS DRY STD. C
Vm(dscm)	STANDARD VOLUME OF GAS SAMPLED,Vm(std),AS DRY STD. C
Vw gas(scf)	VOLUME OF WATER VAPOR IN GAS SAMPLE,STD
% moisture	WATER VAPOR COMPOSITION OF STACK GAS
Md	PROPORTION, BY VOLUME,OF DRY GAS IN GAS SAMPLE
MWd	MOLECULAR WEIGHT OF STACK GAS,DRY BASIS LB/LB-MOLE
MW	MOLECULAR WEIGHT OF STACK GAS,WET BASIC LB/LB-MOLE
Vs(fpm)	AVERAGE STACK GAS VELOCITY
Flow(acfm)	AVERAGE STACK GAS FLOW RATE(ACTUAL STACK COND.)
Flow(acmm)	AVERAGE STACK GAS FLOW RATE(ACTUAL STACK COND.)
Flow(dscfm)	AVERAGE STACK GAS VOLUMETRIC FLOW RATE(DRY BASIS)
Flow(dscmm)	AVERAGE STACK GAS VOLUMETRIC FLOW RATE(DRY BASIS)
% I	PERCENT ISOKINETIC
% EA	PERCENT EXCESS AIR IN STACK GAS
DGM	DRY GAS METER
Y	DRY GAS METER CORRECTION FACTOR
Pg	STACK STATIC GAS PRESSURE
Cp	PITOT COEFFICIENT
dH	ORIFICE PLATE DIFF. PRESS. VALUE
dP	PITOT DIFF. PRESS. VALUE
*** EPA STANDARD CONDITIONS	Temperature = 68 deg-F (528 deg-R) Pressure = 29.92 in. Hg.

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RADIAN SOURCE TEST
EPA METHOD 2-5
SAMPLE CALCULATION
PLANT : SITE-07
PLANT SITE :
SAMPLING LOCATION : BAGHOUSE INLET
TEST # : 07-MM5-BI-01
DATE : 04/16/85
TEST PERIOD : 1444-1604 1642-1657 1740-2005

1) Volume of dry gas sampled at standard conditions (68 deg-F ,29.92 in. Hg)

$$Vm(std) = \frac{Y \times Vm \times [T(std) + 460] \times [Pb + (Pm/13.6)]}{P(std) \times (Tm + 460)}$$

$$Vm(std) = \frac{1.001 \times 130.845 \times 528 \times [\ 29.98 + (\ 1.066875 / 13.6)]}{29.92 \times (\ 77.3021 + 460)}$$

$$Vm(std) = 129.304 dscf$$

2) Volume of water vapor at standard conditions:

$$Vw(gas) = 0.04715\ cf/gm \times W(1)\ gm$$

$$Vw(gas) = 0.04715 \times 375.2 = 17.691\ scf$$

3) Percent Moisture in stack gas :

$$\%M = \frac{100 \times Vw(gas)}{Vm(std) + Vw(gas)}$$

$$\%M = \frac{100 \times 17.691}{129.304 + 17.691} = 12.03\ \%$$

4) Mole fraction of dry stack gas :

$$Md = \frac{100 - \%M}{100} = \frac{100 - 12.03}{100} = .8796508$$

SAMPLE CALCULATION
PAGE TWO

5)Average Molecular Weight of DRY stack gas :

MWd = (.44 x %CO2) + (.32 x %O2) + (.28 x %N2)

MWd = (.44 x 7.6) + (.32 x 13.3) + (.28 x 79.1) = 29.748

6)Average Molecular Weight of wet stack gas :

MW = MWd x Md + 18(1 - Md)

MW = 29.748 x .8796508 + 18(1 - .8796508) = 28.33414

7) Stack gas velocity in feet-per-minute (fpm) at stack conditions :

Vs = KpxCp x [SQRT (dP)]§ave† x SQRT [Ts §avg†] x SQRT [1/(PsxMW)] x 60sec/m

Vs = 85.49 x .84 x 60 x 19.90611 x SQRT[1/(29.61971 X 28.33414)]

Vs = 2960.649 FPM

8) Average stack gas dry volumetric flow rate (DSCFM) :

$$Qsd = \frac{Vs \text{ x } As \text{ x } Md \text{ x } T(std) \text{ x } Ps}{144 \text{ cu.in./cu.ft. x } (Ts + 460) \text{ x } P(std)}$$

$$Qsd = \frac{2960.649 \text{ x } 4320 \text{ x } .8796508 \text{ x} 528 \text{x } 29.61971}{144 \text{ x } 931.4792 \text{ x } 29.92}$$

Qsd = 43842.81 dscfm

SAMPLE CALCULATION
PAGE THREE

```
9)Isokinetic sampling rate (%) :

        Dimensional Constant C = K4 x 60 x 144 x [1 / (Pi  /4)]
        K4 = .0945 FOR ENGLISH UNITS

                   C x Vm(std) x (Ts + 460)
        I% =      ---------------------------------
                  Vs x Tt x Ps x Md x (Dn)*2

                   1039.574 x 129.3039 x 931.4792
        I% = --------------------------------------------
             2960.649 x 240 x 29.61971 x .8796508 x( .254 )*2

        I% =  104.8296

10) Excess air (%) :

                  100 x %O2            100 x 13.3
        EA =      --------------- = ---------------
                  (.264 x %N2) - %O2  (.264 x 79.1 ) - 13.3

        EA =        175.41

11) Particulate Concentration :

        Cs = ( grams part.) / Vm(std) =  0 / 129.3039

        Cs =       0.0000000 Grams/DSCF

                  T(std) x Md x Ps x Cs
        Ca =      ----------------------------
                  P(std) x Ts

                  528 x .8796508  x 29.61971  x      0.0000000
        Ca =      ----------------------------
                  29.92       x      931.4792

        Ca =            0.0000000 Grams/ACF

        LBS/HR =  Cs x 0.002205 x Qsd x 60

        LBS/HR =        0.0000000x 0.002205 x 43842.8 x 60

        LBS/HR = 0

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A-2

CALCULATIONS - BAGHOUSE INLET

MM5 RUNS

```
      R A D I A N   S O U R C E   T E S T
      E P A   M E T H O D   2 - 5
      ( R A W   D A T A )
   PLANT                 : SITE-07
   PLANT SITE            :
   SAMPLING LOCATION     : BAGHOUSE INLET
   TEST #                : 07-MM5-BI-01
   DATE                  : 04/16/85
   TEST PERIOD           : 1444-1604 1642-1657 1740-2005

 PARAMETER                                  VALUE
 ---------                                  -----

 Sampling time (min.)                        240
 Barometric Pressure (in.Hg)                 29.98
 Sampling nozzle diameter (in.)              .254
 Meter Volume (cu.ft.)                       130.845
 Meter Pressure (in.H2O)                     1.066875
 Meter Temperature (F)                       77.3021
 Stack dimension (sq.in.)                    4320
 Stack Static Pressure (in.H2O)             -4.9
 Stack Moisture Collected (gm)               375.2
 Absolute stack pressure(in Hg)              29.61971
 Average stack temperature (F)               471.4792
 Percent CO2                                 7.6
 Percent O2                                  13.3
 Percent N2                                  79.1
 Delps Subroutine result                     19.90611
 DGM Factor                                  1.001
 Pitot Constant                              .84
```

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```
   R A D I A N   S O U R C E   T E S T
   E P A   M E T H O D S   2 - 5
   F I N A L   R E S U L T S
PLANT                : SITE-07
PLANT SITE           :
SAMPLING LOCATION    : BAGHOUSE INLET
TEST #               : 07-MM5-BI-01
DATE                 : 04/16/85
TEST PERIOD          : 1444-1604 1642-1657 1740-2005

   PARAMETER               RESULT
   ---------               ------

   Vm(dscf)                 129.3039
   Vm(dscm)                 3.661886
   Vw gas(scf)              17.69068
   Vw gas (scm)             .5010001
   % moisture               12.03492
   Md                       .8796508
   MWd                      29.748
   MW                       28.33414
   Vs(fpm)                  2960.649
   Vs (mpm)                 902.6369
   Flow(acfm)               88819.47
   Flow(acmm)               2515.367
   Flow(dscfm)              43842.81
   Flow(dscmm)              1241.628
   % I                      104.8296
   % EA                     175.4062



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```
     R A D I A N   S O U R C E   T E S T
     E P A   M E T H O D   2 - 5
     ( R A W   D A T A )
   PLANT                : SITE-07
   PLANT SITE           :
   SAMPLING LOCATION    : BAGHOUSE INLET
   TEST #               : 07-MM5-BI-02
   DATE                 : 04/17/85
   TEST PERIOD          : 1023-1223 1230-1430


 PARAMETER                                VALUE
 ---------                                -----

 Sampling time (min.)                      240
 Barometric Pressure (in.Hg)               30.08
 Sampling nozzle diameter (in.)            .254
 Meter Volume (cu.ft.)                     124.18
 Meter Pressure (in.H2O)                   .9431251
 Meter Temperature (F)                     73.07291
 Stack dimension (sq.in.)                  4320
 Stack Static Pressure (in.H2O)           -4.9
 Stack Moisture Collected (gm)             410
 Absolute stack pressure(in Hg)            29.71971
 Average stack temperature (F)             499.3542
 Percent CO2                               9.899999
 Percent O2                                13.9
 Percent N2                                76.2
 Delps Subroutine result                   19.58622
 DGM Factor                                1.0013
 Pitot Constant                            .84
```

```
        R A D I A N   S O U R C E   T E S T
        E P A   M E T H O D S   2 - 5
        F I N A L   R E S U L T S
PLANT                : SITE-07
PLANT SITE           :
SAMPLING LOCATION    : BAGHOUSE INLET
TEST #               : 07-MM5-BI-02
DATE                 : 04/17/85
TEST PERIOD          : 1023-1223 1230-1430

        PARAMETER                  RESULT
        ---------                  ------

        Vm(dscf)                    124.1022
        Vm(dscm)                    3.514574
        Vw gas(scf)                 19.3315
        Vw gas (scm)                .5474681
        % moisture                  13.47766
        Md                          .8652234
        MWd                         30.14
        MW                          28.50381
        Vs(fpm)                     2899.497
        Vs (mpm)                    883.9931
        Flow(acfm)                  86984.91
        Flow(acmm)                  2463.413
        Flow(dscfm)                 41144.34
        Flow(dscmm)                 1165.208
        % I                         107.2111
        % EA                        223.5878




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```

RADIAN SOURCE TEST
EPA METHOD 2-5
(RAW DATA)

PLANT : SITE 07
PLANT SITE :
SAMPLING LOCATION : BAGHOUSE INLET
TEST # : 07-MM5-BI-03
DATE : 04/18/85
TEST PERIOD : 0948-1148 1200-1400

PARAMETER	VALUE
Sampling time (min.)	240
Barometric Pressure (in.Hg)	30.04
Sampling nozzle diameter (in.)	.254
Meter Volume (cu.ft.)	123.103
Meter Pressure (in.H2O)	.89
Meter Temperature (F)	75.33
Stack dimension (sq.in.)	4320
Stack Static Pressure (in.H2O)	-4.9
Stack Moisture Collected (gm)	358.6
Absolute stack pressure(in Hg)	29.67971
Average stack temperature (F)	488.9167
Percent CO2	8.8
Percent O2	13.9
Percent N2	77.3
Delps Subroutine result	18.98208
DGM Factor	1.001
Pitot Constant	.84

```
    R A D I A N   S O U R C E   T E S T
    E P A   M E T H O D S   2 - 5
    F I N A L   R E S U L T S
PLANT                  : SITE 07
PLANT SITE             :
SAMPLING LOCATION      : BAGHOUSE INLET
TEST #                 : 07-MM5-BI-03
DATE                   : 04/18/85
TEST PERIOD            : 0948-1148 1200-1400

    PARAMETER
    ---------                    RESULT
                                 ------
    Vm(dscf)
    Vm(dscm)                      122.2921
    Vw gas(scf)                   3.463313
    Vw gas (scm)                  16.90799
    % moisture                    .4788343
    Md                            12.14654
    MWd                           .8785346
    MW                            29.964
    Vs(fpm)                       28.51079
    Vs (mpm)                      2811.612
    Flow(acfm)                    857.1987
    Flow(acmm)                    84348.34
    Flow(dscfm)                   2388.745
    Flow(dscmm)                   40901.51
    % I                           1158.331
    % EA                          106.2747
                                  213.6095




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```

A-3

CALCULATIONS - BAGHOUSE OUTLET

MM5 RUNS

RADIAN SOURCE TEST
EPA METHOD 2-5
(RAW DATA)

PLANT : SITE-07
PLANT SITE :
SAMPLING LOCATION : BAGHOUSE OUTLET
TEST # : 07-MM5-BO-01
DATE : 04/16/85
TEST PERIOD : 1450-1550 1600-1900

PARAMETER	VALUE
Sampling time (min.)	240
Barometric Pressure (in.Hg)	29.98
Sampling nozzle diameter (in.)	.246
Meter Volume (cu.ft.)	120.117
Meter Pressure (in.H2O)	.83125
Meter Temperature (F)	79.33335
Stack dimension (sq.in.)	4248
Stack Static Pressure (in.H2O)	-21
Stack Moisture Collected (gm)	310.9
Absolute stack pressure(in Hg)	28.43588
Average stack temperature (F)	424.3125
Percent CO2	5.9
Percent O2	15.9
Percent N2	78.2
Delps Subroutine result	19.43169
DGM Factor	.9955
Pitot Constant	.84

```
   R A D I A N   S O U R C E   T E S T
   E P A   M E T H O D S   2 - 5
   F I N A L   R E S U L T S
PLANT                : SITE-07
PLANT SITE           :
SAMPLING LOCATION    : BAGHOUSE OUTLET
TEST #               : 07-MM5-BO-01
DATE                 : 04/16/85
TEST PERIOD          : 1450-1550 1600-1900

   PARAMETER                RESULT
   ---------                ------

   Vm(dscf)                  117.5376
   Vm(dscm)                  3.328666
   Vw gas(scf)               14.65894
   Vw gas (scm)              .415141
   % moisture                11.08874
   Md                        .8891126
   MWd                       29.58
   MW                        28.29592
   Vs(fpm)                   2951.625
   Vs (mpm)                  899.8858
   Flow(acfm)                87072.94
   Flow(acmm)                2465.906
   Flow(dscfm)               43931.23
   Flow(dscmm)               1244.132
   % I                       99.69472
   % EA                      335.1038




                                      Program Revision:1/16
```

RADIAN SOURCE TEST
EPA METHOD 2-5
(RAW DATA)

PLANT : SITE-07
PLANT SITE :
SAMPLING LOCATION : BAGHOUSE OUTLET
TEST # : 07-MM5-BO-02
DATE : 04/17/85
TEST PERIOD : 1015-1215 1220-1420

PARAMETER	VALUE
Sampling time (min.)	240
Barometric Pressure (in.Hg)	30.08
Sampling nozzle diameter (in.)	.246
Meter Volume (cu.ft.)	122.234
Meter Pressure (in.H2O)	.8720832
Meter Temperature (F)	78.29166
Stack dimension (sq.in.)	4248
Stack Static Pressure (in.H2O)	-21
Stack Moisture Collected (gm)	366.7
Absolute stack pressure(in Hg)	28.53588
Average stack temperature (F)	446.0833
Percent CO2	9.3
Percent O2	15.2
Percent N2	75.5
Delps Subroutine result	19.71894
DGM Factor	.9955
Pitot Constant	.84

```
   R A D I A N   S O U R C E   T E S T
   E P A   M E T H O D S   2 - 5
   F I N A L   R E S U L T S
PLANT                : SITE-07
PLANT SITE           :
SAMPLING LOCATION    : BAGHOUSE OUTLET
TEST #               : 07-MM5-BO-02
DATE                 : 04/17/85
TEST PERIOD          : 1015-1215 1220-1420

   PARAMETER                 RESULT
   ---------                 ------

   Vm(dscf)                   120.2515
   Vm(dscm)                   3.405524
   Vw gas(scf)                17.28991
   Vw gas (scm)               .4896502
   % moisture                 12.57069
   Md                         .8742931
   MWd                        30.096
   MW                         28.57545
   Vs(fpm)                    2975.344
   Vs (mpm)                   907.1171
   Flow(acfm)                 87772.65
   Flow(acmm)                 2485.722
   Flow(dscfm)                42649.29
   Flow(dscmm)                1207.828
   % I                        105.0624
   % EA                       321.2173




                                                Program Revision:1/16/
```

RADIAN SOURCE TEST
EPA METHOD 2-5
(RAW DATA)

PLANT : SITE-07
PLANT SITE :
SAMPLING LOCATION : BAGHOUSE OUTLET
TEST # : 07-MM5-BO-3
DATE : 04/18/85
TEST PERIOD : 0950-1112 1117-1235 1312-1432

PARAMETER	VALUE
Sampling time (min.)	240
Barometric Pressure (in.Hg)	30.04
Sampling nozzle diameter (in.)	.246
Meter Volume (cu.ft.)	115.345
Meter Pressure (in.H2O)	.77
Meter Temperature (F)	79.07
Stack dimension (sq.in.)	4248
Stack Static Pressure (in.H2O)	-21
Stack Moisture Collected (gm)	225.09
Absolute stack pressure(in Hg)	28.49589
Average stack temperature (F)	435.3958
Percent CO2	7.1
Percent O2	16.2
Percent N2	76.7
Delps Subroutine result	18.17898
DGM Factor	.9955
Pitot Constant	.84

```
        R A D I A N   S O U R C E   T E S T
        E P A   M E T H O D S   2 - 5
        F I N A L   R E S U L T S
     PLANT               : SITE-07
     PLANT SITE          :
     SAMPLING LOCATION   : BAGHOUSE OUTLET
     TEST #              : 07-MM5-BO-3
     DATE                : 04/18/85
     TEST PERIOD         : 0950-1112 1117-1235 1312-1432


        PARAMETER                  RESULT
        ---------                  ------

        Vm(dscf)                    113.1319
        Vm(dscm)                    3.203894
        Vw gas(scf)                 10.61299
        Vw gas (scm)                .30056
        % moisture                  8.576513
        Md                          .9142349
        MWd                         29.784
        MW                          28.77335
        Vs(fpm)                     2735.453
        Vs (mpm)                    833.9795
        Flow(acfm)                  80695.85
        Flow(acmm)                  2285.307
        Flow(dscfm)                 41433.2
        Flow(dscmm)                 1173.388
        % I                         101.7431
        % EA                        400.1188




                                            Program Revision:1/16
```

A-4

CALCULATIONS - BAGHOUSE OUTLET

HCL RUNS

RADIAN SOURCE TEST
EPA METHOD 2 - 5
(RAW DATA)

PLANT : SITE 07 %MOISTURE PER MM5-BO-1
PLANT SITE :
SAMPLING LOCATION : BAGHOUSE OUTLET
TEST # : 07-HCL-BO-01
DATE : 04/16/85
TEST PERIOD : 1459-1659

PARAMETER	VALUE
Sampling time (min.)	120
Barometric Pressure (in.Hg)	29.98
Sampling nozzle diameter (in.)	.249
Meter Volume (cu.ft.)	59.896
Meter Pressure (in.H2O)	.7383333
Meter Temperature (F)	76.25
Stack dimension (sq.in.)	4248
Stack Static Pressure (in.H2O)	-21
Stack Moisture Collected (gm)	171.0933
Absolute stack pressure(in Hg)	28.43588
Average stack temperature (F)	417.1667
Percent CO2	5.9
Percent O2	15.9
Percent N2	78.2
Delps Subroutine result	17.89605
DGM Factor	.9993
Pitot Constant	.84

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```
   R A D I A N   S O U R C E   T E S T
   E P A   M E T H O D S   2 - 5
   F I N A L   R E S U L T S
PLANT                : SITE 07 %MOISTURE PER MM5-BO-1
PLANT SITE
SAMPLING LOCATION    : BAGHOUSE OUTLET.
TEST #               : 07-HCL-BO-01
DATE                 : 04/16/85
TEST PERIOD          : 1459-1659

   PARAMETER                  RESULT
   ---------                  ------

   Vm(dscf)                    59.15835
   Vm(dscm)                    1.675365
   Vw gas(scf)                 8.067049
   Vw gas (scm)                .2284588
   % moisture                  12
   Md                          .88
   MWd                         29.58
   MW                          28.1904
   Vs(fpm)                     2723.448
   Vs (mpm)                    830.3195
   Flow(acfm)                  80341.71
   Flow(acmm)                  2275.277
   Flow(dscfm)                 40446.47
   Flow(dscmm)                 1145.444
   % I                         106.3912
   % EA                        335.1038



                                       Program Revision:1/1
```

```
      R A D I A N   S O U R C E   T E S T
      E P A   M E T H O D   2 - 5
      ( R A W   D A T A )
   PLANT                   : SITE-07
   PLANT SITE              :
   SAMPLING LOCATION       : BAGHOUSE OUTLET
   TEST #                  : 07-HCL-BO-02
   DATE                    : 04/17/85
   TEST PERIOD             : 1023-1223

 PARAMETER                                 VALUE
 ---------                                 -----

 Sampling time (min.)                       120
 Barometric Pressure (in.Hg)                30.08
 Sampling nozzle diameter (in.)             .249
 Meter Volume (cu.ft.)                      66.844
 Meter Pressure (in.H20)                    .8899999
 Meter Temperature (F)                      73.75
 Stack dimension (sq.in.)                   4248
 Stack Static Pressure (in.H2O)            -21
 Stack Moisture Collected (gm)              208.7
 Absolute stack pressure(in Hg)             28.53588
 Average stack temperature (F)              436.75
 Percent CO2                                9.3
 Percent O2                                 15.2
 Percent N2                                 75.5
 Delps Subroutine result                    19.93786
 DGM Factor                                 .9993
 Pitot Constant                             .84
```

```
   R A D I A N   S O U R C E   T E S T
   E P A   M E T H O D S   2 - 5
   F I N A L   R E S U L T S
PLANT                 : SITE-07
PLANT SITE            :
SAMPLING LOCATION     : BAGHOUSE OUTLET
TEST #                : 07-HCL-BO-02
DATE                  : 04/17/85
TEST PERIOD             1023-1223

   PARAMETER                    RESULT
   ---------                    ------

   Vm(dscf)                      66.5755
   Vm(dscm)                      1.885418
   Vw gas(scf)                   9.840205
   Vw gas (scm)                  .2786746
   % moisture                    12.8772
   Md                            .871228
   MWd                           30.096
   MW                            28.53837
   Vs(fpm)                       3010.33
   Vs (mpm)                      917.7836
   Flow(acfm)                    88804.74
   Flow(acmm)                    2514.95
   Flow(dscfm)                   43447.04
   Flow(dscmm)                   1230.42
   % I                           111.4613
   % EA                          321.2173




                                             Program Revision:1/16
```

```
    RADIAN SOURCE TEST
    EPA METHOD 2-5
    (RAW DATA)
  PLANT               : SITE-07
  PLANT SITE          :
  SAMPLING LOCATION   : BAGHOUSE OUTLET
  TEST #              : 07-HCL-BO-3
  DATE                : 04/18/85
  TEST PERIOD         : 0958-1008 1026-1216

PARAMETER                               VALUE
---------                               -----

Sampling time (min.)                     120
Barometric Pressure (in.Hg)              30.04
Sampling nozzle diameter (in.)           .249
Meter Volume (cu.ft.)                    49.946
Meter Pressure (in.H2O)                  .51
Meter Temperature (F)                    75.2
Stack dimension (sq.in.)                 4248
Stack Static Pressure (in.H2O)          -21
Stack Moisture Collected (gm)            120.2
Absolute stack pressure(in Hg)           28.49589
Average stack temperature (F)            410.5
Percent CO2                              7.1
Percent O2                               16.2
Percent N2                               76.7
Delps Subroutine result                  14.90879
DGM Factor                               .9993
Pitot Constant                           .84
```

```
   R A D I A N   S O U R C E   T E S T
   E P A   M E T H O D S   2 - 5
   F I N A L   R E S U L T S
PLANT                : SITE-07
PLANT SITE           :
SAMPLING LOCATION    : BAGHOUSE OUTLET
TEST #               : 07-HCL-BO-3
DATE                 : 04/18/85
TEST PERIOD          : 0958-1008 1026-1216

   PARAMETER                 RESULT
   ---------                 ------

   Vm(dscf)                   49.49879
   Vm(dscm)                   1.401806
   Vw gas(scf)                5.66743
   Vw gas (scm)               .1605016
   % moisture                 10.27337
   Md                         .8972663
   MWd                        29.784
   MW                         28.57339
   Vs(fpm)                    2251.212
   Vs (mpm)                   686.345
   Flow(acfm)                 66410.74
   Flow(acmm)                 1880.752
   Flow(dscfm)                34422.74
   Flow(dscmm)                974.8519
   % I                        104.597
   % EA                       400.1188




                                           Program Revision:1/16
```

A-5

BAGHOUSE INLET

MM5 RUN SHEETS

MODIFIED METHOD 5 DATA

INLET

Page 1 of 4

PLANT 07
DATE 4-16-85
SAMPLING LOCATION Inlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-01
OPERATOR MCR
AMBIENT TEMPERATURE 65
BAROMETRIC PRESSURE 29.98
STATIC PRESSURE (P_s) -4.9
FILTER NUMBER (s) NA
MINIMUM SAMPLE VOLUME 120
INITIAL LEAK CHECK .013 at 15"

PROBE LENGTH AND TYPE 8' Glass
NOZZLE I.D. .254
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 7
METER BOX NUMBER 2
METER Δ H@ 1.83
C FACTOR .92
PROBE HEATER SETTING 50%
HEATER BOX SETTING 250
REFERENCE Δp .70
DRY/GAS METER FACTOR (Y) 1.001
FINAL LEAK CHECK .02 at 14"

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 5 MINUTES

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T_s, °F	Orifice Pressure Differential (ΔH, in. H₂O)		Temperature [✓ °F] °C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit	
									Skin	Out			Inlet (T_m in)	Outlet (T_m out)		
		1444	308.45													
A-8	5	49	311.0	.34	473	.90	.90	—	271	—	—	52	70	70	59	5
7	10	54	313.8	.38	477	.94	.94	—	267	—	—	51	71	70	60	5
6	15	59	316.51	.44	480	1.1	1.1	—	241	—	—	50	79	71	59	6
5	20	1504	319.57	.49	480	1.2	1.2	—	260	—	—	50	79	71	58	6
4	25	9	322.73	.55	476	1.35	1.35	—	266	—	—	50	83	72	57	7
3	30	14	326.01	.55	466	1.35	1.35	—	253	—	—	50	84	72	56	7
2	35	19	329.2	.54	463	1.3	1.3	—	257	—	—	49	84	73	55	7
1	40	24	332.1	.53	453	1.3	1.3	—	254	—	—	48	85	72	55	7
B-8	45	29	333.61	.32	478	.78	.78	—	245	—	—	51	81	73	55	7
7	50	34	335.4	.25	490	.55	.55	—	257	—	—	51	80	72	54	5
6	55	39	337.52	.32	481	.78	.78	—	270	—	—	51	80	73	54	14
5	60	44	340.23	.39	484	.95	.95	—	268	—	—	49	79	72	54	11
4	65	49	343.27	.55	480	1.35	1.35	—	276	—	—	53	83	73	56	9
3	70	54	346.7	.58	472	1.45	1.45	—	266	—	—	50	87	71	57	10
2	75	59	349.9	.54	463	1.3	1.3	—	275	—	—	51	89	75	57	9
1	80	1604	352.71	.46	457	1.1	1.1	—	264	—	—	50	88	75	58	8

Bag 1447

Bag #6 1605

COMMENTS

Stop Leak Check

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MODIFIED METHOD 5 DATA

PLANT 07
DATE 4-16-85
SAMPLING LOCATION Baghouse Inlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-01
OPERATOR McR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE (P_s)
FILTER NUMBER (s)
MINIMUM SAMPLE VOLUME
INITIAL LEAK CHECK 0.02 AT 15" Final #2 Filter .02 at 15"
0.02 AT 15" Filter #3

Page 2 of 4

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER Δ H@
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp
DRY/GAS METER FACTOR (Y)
FINAL LEAK CHECK

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY ______ MINUTES

changed Filters before "C"

	Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T_s in °F	Orifice Pressure Differential (ΔH, in. H₂O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg	
							Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit		
										Skin	Out			Inlet (T_m in)	Outlet (T_m out)			
Bag on 1644		80	~~1642~~ ~~1442~~	353.34														
off 1657	C-8	85	47	356.0	.32	471	.80	.80	—	265	—	—	53	68	72	54	6	
	7	90	52	358.17	.30	472	.74	.74	—	259	—	—	50	75	73	53	6	Clogging
Filter #3	6	95	57	360.21	.23	473	.56	.56	—	279	—	—	49	78	73	54	16	
	~~5~~	START 95 ~~100~~	1740 ~~1702~~	361.4														
	5 ~~4~~	100	1745	363.55	.23	478	.56	.56	—	286	—	—	53	64	68	55	5	
	4 ~~3~~	105 ~~110~~	50	365.85	.28	482	.68	.68	—	256	—	—	51	68	68	52	6	
Bag on 1741	3 ~~2~~	110 ~~115~~	55	368.26	.30	476	.74	.74	—	252	—	—	48	72	68	53	6	
off 1806	2 ~~1~~	115 ~~120~~	1800	370.85	.34	470	.90	.90	—	262	—	—	47	74	68	54	7	
	C-1 ~~D-8~~	120	1805	373.4	.26	390	.64	.64		280	—	—	48	75	70	55	6	
Bag #2 D-8	~~7~~	125	10	375.16	.35	478	.87	.87	—	251	—	—	47	74	69	55	7	
start 1810 7	~~6~~	130	15	377.—	.35	480	.87	.87	—	290	—	—	46	76	68	54	8	
6	~~5~~	135	20	380.—	.35	481	.87	.87	—	286	—	—	48	78	69	54	8	
5	~~4~~	140	25	382.61	.35	483	.87	.87	—	267	—	—	47	80	70	56	8	
4	~~3~~	145	30	385.6	.43	483	1.1	1.1		287			46	82	71	56	9	
D-3	~~2~~	150	35	388.60	.45	474	1.12	1.12		286			47	83	72	56	9	

COMMENTS

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MODIFIED METHOD 5 DATA

PLANT 07
DATE 4-16-85
SAMPLING LOCATION Baghouse Inlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-01
OPERATOR mcQ
AMBIENT TEMPERATURE ______
BAROMETRIC PRESSURE ______
STATIC PRESSURE (P_s) ______
FILTER NUMBER (s) ______
MINIMUM SAMPLE VOLUME ______
INITIAL LEAK CHECK ______

Page 3 of 4.

PROBE LENGTH AND TYPE 8' GLASS
NOZZLE I.D. ______
ASSUMED MOISTURE, % ______
SAMPLE BOX NUMBER ______
METER BOX NUMBER ______
METER Δ H@ ______
C FACTOR ______
PROBE HEATER SETTING ______
HEATER BOX SETTING ______
REFERENCE Δp ______
DRY/GAS METER FACTOR (Y) ______
FINAL LEAK CHECK ______

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY ______ MINUTES

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H_2O	Stack T_s, in °F	Orifice Pressure Differential (ΔH, in. H_2O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit	
									Skin	Out			Inlet (T_m in)	Outlet (T_m out)		
	150	1435	388.60													
D-2	155	1840	391.60	.53	465	1.3	1.3	—	299	—	—	49	88	74	56	10
1	160	1845	394.20	.38	454	.93	.93	—	289	—	—	46	88	74	56	8
E-8	165	50	396.70	.47	474	1.2	1.2	—	249	—	—	47	85	75	56	8
7	170	55	399.16	.31	475	.75	.75	—	290	—	—	47	86	76	56	7
6	175	1900	401.76	.35	477	.87	.87	—	282	—	—	48	85	76	56	8
5	180	05	404.7	.41	477	1.0	1.0	—	286	—	—	47	86	76	55	9
4	185	10	407.75	.60	477	1.5	1.5	—	270	—	—	48	90	77	57	11
3	190	15	411.21	.60	473	1.5	1.5	—	257	—	—	49	90	76	58	11
2	195	20	414.35	.65	471	1.6	1.6	—	235	—	—	49	92	77	58	12
1	200	1925	417.35	.40	449	.99	.99	—	218	—	—	51	92	77	68	10
F-8	205	30	419.45	.49	480	1.2	1.2	—	249	—	—	46	87	77	54	10
7	210	35	422.4	.45	482	1.1	1.1	—	280	—	—	45	87	76	56	10
6	215	40	425.32	.50	483	1.2	1.2	—	261	—	—	45	87	76	56	11
5	220	45	428.32	.49	480	1.2	1.2	—	272	—	—	45	86	76	56	11
4	225	50	431.56	.63	474	1.55	1.55	—	250	—	—	46	85	76	56	13

COMMENTS

A-35

Bag
%
1924

MODIFIED METHOD 5 DATA

PLANT 07
DATE 4-16-85
SAMPLING LOCATION Baghouse Inlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-01
OPERATOR mcR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE (P_s)
FILTER NUMBER (s)
MINIMUM SAMPLE VOLUME
INITIAL LEAK CHECK

Page 4 of 4

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER Δ H@
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp
DRY/GAS METER FACTOR (Y)
FINAL LEAK CHECK .025 at 16 From the Nozzle .005 at 14 of [illegible] the Front of the cyclone

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY ______ MINUTES

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H_2O	Stack T_s, °F	Orifice Pressure Differential (ΔH, in. H_2O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit	
									Skin	Out			Inlet (T_m in)	Outlet (T_m out)		
F4	225	1950	431.58													
3	230	55	434.90	.63	470	1.55	1.55	—	279	—	—	45	87	74	57	13
2	235	2000	438.1	.62	467	1.50	1.5	—	255	—	-	45	87	74	58	13
1	240	2005	441.165	.57	447	1.25	1.25		276			46	89	74	57	13
	240		130.845		[illegible]		1.07						77.30			

COMMENTS

FIELD DATA

PLANT 07
DATE 4-17-85
SAMPLING LOCATION Baghouse Inlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-02
OPERATOR McR
AMBIENT TEMPERATURE 50
BAROMETRIC PRESSURE ~~29.~~ 30.08
STATIC PRESSURE (P_s) −4.9
FILTER NUMBER (s) NA
MINIMUM SAMPLE VOLUME

1.83

PROBE LENGTH AND TYPE 8' Glass
NOZZLE I.D. .254
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 1
METER BOX NUMBER 2
METER Δ H@ 1.83
C FACTOR .92
PROBE HEATER SETTING 55
HEATER BOX SETTING 250
REFERENCE Δp .75
DRY/GAS METER FACTOR (Y) 1.0013

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY ______ MINUTES

START Leak Rate .015 at 15"

START BAG 1027

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H_2O	Stack T_s, in °F	Orifice Pressure Differential (ΔH, in. H_2O) Desired	Actual	Temperature °F/°C (Circle One) Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	Pump Vacuum in. Hg
	0	1023	442.77													
A-8	5	28	444.95	.25 ~~.23~~	493	.63	.63	239	237	–	–	50	54	54	50	4
~~7A~~ 7	10	33	447.01	.25	499	.58	.58	263	264	–	–	50	58	55	50	4
6	15	38	449.86	.45	502	1.05	1.05	291	243	–	–	51	64	56	49	6
5	20	43	452.6	.46	503	1.05	1.05	269	268	–	–	52	69	58	50	6
4	25	48	455.55	.50	502	1.15	1.15	256	237	–	–	52	75	61	51	7
3	30	53	458.55	.51	495	1.2	1.2	245	270	–	–	53	75	62	52	8
2	35	58	461.48	.49	490	1.1	1.1	273	245	–	–	54	79	64	53	8
1	40	1103	464.15	.38	482	.87	.87	279	273	–	–	55	78	64	53	7
B-8	45	08	465.87	.27	494	.61	.61	252	255	–	–	57	74	66	54	6
7	50	13	467.76	.19	508	.44	.44	252	279	–	–	58	73	66	54	5
6	55	18	469.90	.25	511	.58	.58	272	254	–	–	57	74	67	54	6
5	60	23	472.37	.35	512	.80	.80	262	283	–	–	54	76	68	54	7
4	65	28	475.22	.49	511	1.1	1.1	259	243	–	–	52	78	69	54	9
3	70	33	478.28	.51	503	1.2	1.2	248	258	–	–	51	80	70	54	9
2	75	38	481.14	.48	492	1.1	1.1	247	252	–	–	51	83	71	55	9

COMMENTS

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Bag off 1222

Bag start 1238

A-38

Traverse Point Number	Sampling Time Min. 75	Clock Time (24-hr Clock) 1138	Gas Meter Reading (V_m), ft³ 481.14	Velocity Head (ΔP_s), in. H_2O	Stack T_s, °F	Orifice Pressure Differential (ΔH, in. H_2O)		Temperature [✓ °F] °C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	
B-1	80	1143	483.81	.41	440	.94	.94	264	263	–	–	50	81	70	54	8
E-8	85	48	485.62	.32	507	.70	.70	284	250	–	–	51	79	71	54	7
C-7	90	53	487.6	.21	509	.48	.48	285	260	–	–	54	79	71	55	6
C-6	95	58	489.6	.21	513	.48	.48	304	255	–	–	52	78	71	54	6
C-5	100	1203	491.6	.23	515	.52	.52	295	262	–	–	54	77	71	55	7
C-4	105	08	493.9	.30	514	.70	.70	296	262	–	–	54	78	72	54	8
C-3	110	13	496.5	.37	508	.85	.85	281	263	–	–	56	79	72	55	9
C-2	115	18	499.17	.41	499	.94	.94	279	273	–	–	56	79	72	56	9
C-1	120	1223	501.49	.30	453	.70	.70	265	250	–	–	57	80	72	58	7
STOP.	Leak	Check	.02 at	15" from	The	Nozzle										
START	120	1230	501.69													
D-8	125	35	504.13	.37	506	.85	.85	240	282	–	–	54	72	71	58	9
7	130	40	506.42	.27	511	.62	.62	260	259	–	–	53	75	71	58	8
6	135	45	508.45	.23	512	.52	.52	268	264	–	–	52	76	71	58	7
5	140	50	510.85	.32	514	.74	.74	272	269	–	–	52	74	71	59	8
4	145	55	513.7	.43	513	1.0	1.0	258	254	–	–	50	80	72	57	10
3	150	1300	516.43	.49	504	1.1	1.1	249	260	–	–	52	81	71	59	11
2	155	05	519.46	.59	496	1.35	1.35	249	249	–	–	53	82	71	60	12
1	160	10	522.06	.36	471	.83	.83	246	273	–	–	55	84	71	61	10
E-8	165	15	524.10	.50	508	1.1	1.1	242	270	–	–	53	78	71	60	11
7	170	20	526.53	.32	511	.74	.74	254	276	–	–	53	79	71	61	9
6	175	25	529.0	.40	513	.92	.92	265	253	–	–	51	78	71	61	10
5	180	30	532.0	.49	514	1.1	1.1	264	282	–	–	51	79	70	61	12
4	185	35	534.95	.58	511	1.35	1.35	206	235	–	–	49	80	70	61	13
TOTAL		●		●	●	●	●	●	●	●	●	●	●	●	●	●
AVERAGE	●	●	●	●		●		●	●	●	●	●			●	●

FIELD DATA

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PLANT 07
DATE 4-17-85
SAMPLING LOCATION Baghouse Inlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-02
OPERATOR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE (P_s)
FILTER NUMBER (s)
MINIMUM SAMPLE VOLUME .0

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER Δ H@
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp
DRY/GAS METER FACTOR (Y)

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY ______ MINUTES

Leak Rate .03 at 16" from the nozzle
" " .01 at 16" from front of Cyclone

Bag 86
1348

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H_2O	Stack T_s, in °F	Orifice Pressure Differential (ΔH, in. H_2O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit	
									Skin	Out			Inlet (T_m in)	Outlet (T_m out)		
E-3	190	13 40	538.04	.58	504	1.35	1.35	273	250	-	-	49	82	69	61	13
2	195	45	541.15	.58	498	1.35	1.35	304	275	-	-	51	84	70	62	14
1	200	13 50	544.01	.52	487	1.2	1.2	265	255	-	-	52	83	71	62	13
F-1	205	55	546.42	.54	470	1.25	1.25	265	263	-	-	53	79	69	61	13
2	210	1400	549.46	.54	490	1.25	1.25	290	280	-	-	53	81	69	62	14
3	215	05	552.80	.59	492	1.35	1.35	268	258	-	-	53	82	70	62	14
4	220	10	555.75	.60	495	1.4	1.4	252	285	-	-	51	83	70	64	15
5	225	15	558.78	.54	498	1.25	1.25	259	263	-	-	50	84	70	64	14
6	230	20	561.81	.52	500	1.2	1.2	270	240	-	-	50	85	70	64	14
7	235	25	564.6	.39	500	.90	.90	269	289	-	-	53	85	70	65	13
8	240	30	567.15	.34	496	.78	.78	278	264	-	-	54	83	71	65	11
													✓			
	240		124.18		499.3		.94						73.07			

COMMENTS

A-39

FIELD DATA

PLANT 07
DATE 4-18-85
SAMPLING LOCATION Baghouse Inlet
SAMPLE TYPE MMS
RUN NUMBER 07-MMS-03
OPERATOR McR
AMBIENT TEMPERATURE 55
BAROMETRIC PRESSURE 30.04
STATIC PRESSURE (P_s) -4.9
FILTER NUMBER (s) NA
MINIMUM SAMPLE VOLUME

Page 1 of 3

PROBE LENGTH AND TYPE 8' Glass
NOZZLE I.D. .254
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 7
METER BOX NUMBER 2
METER Δ H@ 1.83
C FACTOR .92
PROBE HEATER SETTING 60%
HEATER BOX SETTING 250
REFERENCE Δp .80
DRY/GAS METER FACTOR (Y) 1.001

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 5 MINUTES

A41

Bag start 958

Traverse Point Number	Sampling Time Min ○	Clock Time (24-hr Clock) 0948	Gas Meter Reading (V_m), ft³ 568.511	Velocity Head (ΔP_s), in. H_2O	Stack T_s in °F	Orifice Pressure Differential (ΔH, in. H_2O) Desired	Orifice Pressure Differential (ΔH, in. H_2O) Actual	Temperature °F/°C (Circle One) Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	Pump Vacuum in. Hg
A-8	5	53	571.20	.25	497	.57	.57	273	246			45	54	54	47	4
7	10	58	572.65	.34	492	.79	.79	281	277			46	58	56	48	5
6	15	1003	575.37	.42	492	.95	.95	289	265 287			47	60	56	49	6
5	20	08	578.22	.50	492	1.15	1.15	299	239			49	65	57	50	6
4	25	13	581.2	.50	490	1.15	1.15	264	269			50	70	58	50	6
3	30	18	584.2	.55	477	1.25	1.25	256	254			47	75	60	51	6
2	35	23	587.16	.50	472	1.15	1.15	246	254			46	77	61	51	6
1	40	28	589.5	.39	424	.90	.90	242	259			47	78	62	51	6
B-8	45	33	591.64	.31	494	.71	.71	233	272			50	76	63	51	6
7	50	38	593.70	.29	495	.67	.67	249	262			45	77	64	51	5
6	55	43	596.2	.29	497	.67	.67	262	257			44	77	64	51	5
5	60	48	598.8	.37	498	.85	.85	264	273			43	78	66	51	6
4	65	53	601.6	.59	498	1.15	1.15	261	260			43	81	66	51	7
3	70	58	604.4	.50	488	1.15	1.15	259	281			43	83	68	51	7
2	75	1103	607.5	.50	479	1.15	1.15	253	293			44	84	68	51	7

COMMENTS

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07-MM5-BI-03 page 2 of 3

Bag #6 201

Leak Check .01 at 15" probe

Bag START 1204

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	607.5 Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H_2O	Stack T_s in °F	Orifice Pressure Differential (ΔH, in. H_2O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	
1	80	1108	609.9	.35	466	.80	.80	281	279			45	87	69	51	6
E 8	85	13	611.89	.27	491	.62	.62	243	220			45	85	70	51	6
C-7	90	18	614.0	.22	499	.50	.50	244	248			45	87	71	51	5
6	95	23	615.80	.19	502	.44	.44	255	283			47	85	71	48	5
5	100	28	617.80	.22	503	.50	.50	258	247			46	84	72	51	6
4	105	33	620.27	.34	502	.78	.78	250	268			47	84	72	50	7
3	110	38	622.68	.32	492	.73	.73	258	246			50	86	73	51	7
2	115	43	625.38	.41	483	.95	.95	247	279			51	85	73	52	8
1	120	48	627.644	.27	468	.62	.62	250	234			53	85	72	52	7
STOP	120	1200	628.630													
D-8	125	5	630.71	.41	497	.95	.95	239	124			54	75	73	53	8
7	130	10	632.98	.28	501	.64	.64	257	262			52	79	73	52	7
6	135	15	635.16	.24	504	.55	.55	256	250			51	78	73	53	6
5	140	20	637.340	.30	506	.69	.69	259	258			49	74	71	52	6
4	145	25	639.87	.40	505	.93	.93	256	253			50	73	69	50	8
3	150	30	642.53	.40	500	.93	.93	272	257			51	74	67	52	8
2	155	35	645.47	.51	491	1.15	1.15	263	249			54	77	66	54	10
1	160	40	648.74	.31	478	.72	.72	267	252			54	82	67	53	7
E-8	165	45	650.8	.45	503	1.05	1.05	241	255			51	86	69	54	9
7	170	50	653	.28	500	.72	.72	259	254			51	88	70	54	10
6	175	55	655.6	.41	505	.95	.95	267	252			52	87	70	54	9
5	180	1300	658.4	.42	504	.96	.96	268	272			51	90	71	53	10
4	185	05	661.27	.55	501	1.3	1.3	272	250			54	95	73	55	11
3	190	10	664.41	.53	494	1.2	1.2	262	290			56	97	73	56	12
TOTAL		●		●	●	●	●	●	●	●	●	●	●	●	●	●
AVERAGE	●	●	●	●		●		●	●	●	●	●			●	●

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FIELD DATA

PLANT 07
DATE 4-18-85
SAMPLING LOCATION Baghouse Inlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-03
OPERATOR McR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE (P_s)
FILTER NUMBER (s)
MINIMUM SAMPLE VOLUME

Page 3 of 3

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER Δ H@
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp
DRY/GAS METER FACTOR (Y)

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY ______ MINUTES

Final Leak Rate .02 at 2" from the Nozzle
Final Leak Rate Before probe .014

A-43

Bing 46
1316

Traverse Point Number	Sampling Time Min. 190	Clock Time (24-hr Clock) 1310	Gas Meter Reading (V_m), ft³ 664.41	Velocity Head (ΔP_s), in. H_2O	Stack T, in °F	Orifice Pressure Differential (ΔH, in. H_2O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	
E-2	195	15	667.5	.50	482	1.15	1.15	269	251	—	—	47	103	77	56	12
E-1	200	1320	670.1	.35	456	.80	.80	263	226	—	—	43	104	78	56	9
F-1	205	25	672.9	.38	470	.87	.87	244	253	—	—	44	100	79	56	10
2	210	30	675.44	.45	473	1.05	1.05	237	246	—	—	45	98	80	55	11
3	215	35	678.7	.45	480	1.05	1.05	239	237	—	—	46	95	80	55	11
4	220	40	681.1	.50	484	1.15	1.15	243	248			45	84	75	53	13
5	225	45	684.0	.45	484	1.05	1.05	246	251			46	82	72	53	13
6	230	50	686.7	.42	487	.96	.96	246	269			48	82	70	51	12
7	235	55	689.37	.38	490	.87	.87	254	255			47	84	69	52	11
8	240	1400	692.0	.33	490	.75	.75	263	269			47	85	68	52	10
													✓			
			123.103		444.92		.89						75.33			

COMMENTS

A-6

BAGHOUSE OUTLET

MM5 RUN SHEETS

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MODIFIED METHOD 5 DATA

PLANT Site 07
DATE 4-16-85
SAMPLING LOCATION OUTLET
SAMPLE TYPE MMS
RUN NUMBER 07-MMS-1
OPERATOR HENRY GARCIA
AMBIENT TEMPERATURE 55°F
BAROMETRIC PRESSURE 29.98
STATIC PRESSURE (P_s) -21.0" H2O
FILTER NUMBER (s) —
MINIMUM SAMPLE VOLUME 120 CF[redacted] 1084
INITIAL LEAK CHECK .015
MID TEST LEAKCHECK .003

PROBE LENGTH AND TYPE 4' Glass
NOZZLE I.D. .246
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 9E
METER BOX NUMBER 7
METER Δ H@ 1.85
C FACTOR [redacted] .82
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F
REFERENCE Δp .96
DRY/GAS METER FACTOR (Y) .9955
FINAL LEAK CHECK .010

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY [redacted] 10 MINUTES

A-47

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T in °F	Orifice Pressure Differential (ΔH, in. H₂O) Desired	Actual	Temperature °F/°C (Circle One) Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	Pump Vacuum in. Hg
	0	1450	206.446													
F-4	5	55	209.010	.65	425	1.25	1.25	281	216	/	—	50	60	60	72	8
[redacted]	10	1500	211.060	.64	426	1.20	1.20	300	262	/	—	48	65	60	77	10
3	15	05	215.125	.70	424	1.30	1.30	400	272	/	—	47	70	61	74	10
[redacted]	20	10	218.075	.64	428	1.20	1.20	404	267	/	—	47	75	62	73	10
2	25	15	221.035	.64	424	1.20	1.20	316	268	/	—	47	71	65	80	10
	30	20	222.890	.55	424	1.05	1.05	209	257	/	—	47	69	67	82	10
1	35	25	226.265	.32	423	.60	.60	185	246	/	—	49	69	69	83	8
	40	30	228.460	.30	425	.56	.56	179	232	/	—	50	73	71	75	8
E-4	45	35	230.750	.40	423	.76	.76	246	224	/	—	49	73	72	82	8
	50	40	233.55	.40	425	.76	.76	367	250	/	—	47	74	73	83	8
3	55	45	235.30	.43	425	.82	.82	402	267	/	—	49	75	74	47	8
	60	50	238.670	.41	425	.78	.78	414	261	/	—	48	89	74	46	7
[redacted]				~~.33~~												
[redacted]	60	1600	240.264		BRO	KEN	U-T	UBE								
2	65	05	242.120	.35	424	.66	.16	141	250	/	—	50	77	76	50	8

CK LK STOP
~~START~~
LK CK .003 START

COMMENTS

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MODIFIED METHOD 5 DATA

PLANT Site 07
DATE 4-16-85
SAMPLING LOCATION outlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-01
OPERATOR Henry-Garcia
AMBIENT TEMPERATURE 55°F
BAROMETRIC PRESSURE 28.98
STATIC PRESSURE (P_s) -21.0" H2O
FILTER NUMBER (s) –
MINIMUM SAMPLE VOLUME

INITIAL LEAK CHECK .015
M.D Test LKCK .003

PROBE LENGTH AND TYPE 4' Glass
NOZZLE I.D. .246
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 9E
METER BOX NUMBER 7
METER Δ H@ 1.85
C FACTOR .82
PROBE HEATER SETTING 250
HEATER BOX SETTING 290
REFERENCE Δp .56
DRY/GAS METER FACTOR (Y) .9955
FINAL LEAK CHECK .010

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SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 5 MINUTES

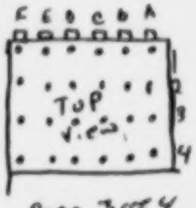
Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T_s °F	Orifice Pressure Differential (ΔH, in. H₂O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit	
									Skin	Out			Inlet (T_m in)	Outlet (T_m out)		
	65	1605	242.120													
E-2	70	r 10	244.67	.40	424	.76	.76	149	242	–	—	47	81	76	48	8
E-1	75	15	246.685	.27	422	.50	.50	164	245	–	–	50	83	78	48	8
	80	20	248.710	.25	422	.46	.46	162	242	–	–	50	83	78	50	8
D-4	85	25	251.450	.60	426	1.15	1.15	221	238	–	–	50	82	77	47	10
	90	30	254.540	.53	428	1.05	1.05	361	266	–	–	48	82	77	47	10
D-3	95	35	257.040	.50	417	.95	.95	409	286	–	–	47	88	78	48	10
	100	40	259.93	.52	424	1.0	1.0	408	280	–	–	48	87	78	48	10
D-2	105	45	262.18	.36	424	.68	.68	357	275	–	–	48	86	77	48	8
	110	50	264.63	.40	423	.76	.76	240	263	–	–	48	85	77	48	9
D-1	115	55	266.81	.31	421	.57	.57	208	268	–	–	47	86	78	48	8
	120	1900	269.36	.31	421	.57	.57	189	245	–	–	48	85	79	49	8
C-4	125	05	271.64	.55	422	1.05	1.05	220	237	–	–	48	85	78	47	10
	130	10	274.55	.60	425	1.15	1.15	342	251	–	–	49	88	79	48	10
C-3	135	15	277.58	.66	423	1.25	1.25	372	267	–	–	48	89	79	49	10
	140	20	280.59	.57	425	1.1	1.1	348	270	–	–	47	91	80	50	10

COMMENTS

A-48

FIELD DATA

PLANT Site 07
DATE 4-16-85
SAMPLING LOCATION outlet
SAMPLE TYPE MMS
RUN NUMBER 07-MMS-01-outlet
OPERATOR Henry, Garcia
AMBIENT TEMPERATURE 55°F
BAROMETRIC PRESSURE 29.98
STATIC PRESSURE (P_s) -21.0" H₂O
FILTER NUMBER (s) —
MINIMUM SAMPLE VOLUME 130 ft³



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SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 5 MINUTES

PROBE LENGTH AND TYPE 4' Glass
NOZZLE I.D. .246
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 9E
METER BOX NUMBER 7
METER Δ H@ 1.85
C FACTOR .82
PROBE HEATER SETTING 250
HEATER BOX SETTING 250
REFERENCE Δp .96
DRY/GAS METER FACTOR (Y) .9955

Traverse Point Number	Sampling Time Min. 190	Clock Time (24-hr Clock) 1720	280.59 Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T_s in °F	Orifice Pressure Differential (ΔH, in. H₂O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit	
									Skin	Out			Inlet (T_m in)	Outlet (T_m out)		
C-2	145	25	283.30	.48	426	.92	.92	300	269	-	—	49	93	81	49	9
	150	30	285.79	.40	427	.77	.77	236	263	-	—	48	91	82	50	9
C-1	155	35	287.81	.26	424	.48	.48	212	256	-	—	49	89	81	51	8
	160	40	289.86	.24	425	.45	.45	185	245	-	—	50	85	81	51	8
D-4	165	45	292.3	.51	430	.97	.97	228	236	-	—	52	84	80	48	10
	170	50	295.1	.51	429	.97	.97	347	251	—	—	52	86	80	49	10
D-3	175	55	297.74	.48	429	.92	.92	384	269	—	—	53	88	80	50	10
	180	1800	300.43	.49	430	.95	.95	390	260	-	—	54	87	80	54	10
D-2	185	05	302.69	.40	424	.77	.77	333	256	—	-	55	86	79	50	10
	190	10	305.32	.36	426	.69	.69	216	242	—	—	57	85	79	50	10
B-1	195	15	307.33	.27	421	.52	.52	187	235	—	-	56	85	79	50	8
	200	20	309.28	.25	425	.47	.47	164	224	—	-	56	85	79	50	8
A-4	205	25	311.73	.41	422	.78	.78	160	206	—	-	58	85	79	58	8
	210	30	314.17	.40	424	.77	.77	364	238	-	-	57	87	80	50	8
A-3	215	35	316.55	.48	423	.80	.80	395	257	-	-	60	88	80	50	9

COMMENTS Conclusion of test is on the back page

07- MMS · BO-1 Page 4 of 4

Traverse Point Number A-3	Sampling Time Min. 215	Clock Time (24-hr Clock) 35	316.55 Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T_s, °F	Orifice Pressure Differential (ΔH, in. H₂O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
									Filter				Dry Gas Meter			
						Desired	Actual	Probe	Skin	Out	Recirc. Water	Absorbent Trap	Inlet (T_m in)	Outlet (T_m out)	Impinger Exit	
A-3	230	40	319.31	.40	427	.77	.77	401	253	—	—	61	88	80	51	9
A-2	225	45	321.52	.43	422	.86	.86	279	247	—	—	60	89	80	50	9
	230	50	324.12	.43	422	.86	.86	199	241	—	—	54	90	81	51	9
A-1	235	55	326.20	.27	421	.52	.52	164	232	—	—	60	86	81	51	8
	240	1900	328.157	.27	417	.52	.52	149	220	-	—	61	88	81	51	8
END of TEST																
	240		120,117		424.3		10.83									
													79.3			
TOTAL		●		●	●	●	●	●	●	●	●	●	●	●	●	●
AVERAGE	●	●	●	●		●		●	●	●	●	●			●	●

FIELD DATA

PLANT Site 07
DATE 4/13/85
SAMPLING LOCATION Baghouse outlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-02
OPERATOR Alg gdh
AMBIENT TEMPERATURE 57
BAROMETRIC PRESSURE 30.08
STATIC PRESSURE (P_s) -21"
FILTER NUMBER (s) –
MINIMUM SAMPLE VOLUME 120 f³
INT LK CK .015
mid LK CK .017
Final LK CK .007

Page 1 of 3

PROBE LENGTH AND TYPE 4' glass
NOZZLE I.D. .246
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 9E
METER BOX NUMBER 7
METER Δ H@ 1.85
C FACTOR .82
PROBE HEATER SETTING 250
HEATER BOX SETTING 250
REFERENCE Δp .95
DRY/GAS METER FACTOR (Y) .9955

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 5 MINUTES

Traverse Point Number	Sampling Time Min	1015 Clock Time (24-hr Clock)	328.943 Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H_2O	Stack T_s in °F	Orifice Pressure Differential (ΔH, in. H_2O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	
F-4	5	1020	331.4	.65	430	1.3	1.3	260	226			51	62	59	49	4
F-4	10	25	334.5	.65	436	1.3	1.3	360	248			53	67	60	47	4
3	15	30	337.9	.85	435	1.7	1.7	410	266			49	77	63	46	5
3	20	35	341.5	.85	436	1.7	1.7	422	254			51	80	65	47	5
2	25	40	344.7	.65	444	1.3	1.3	424	253			50	81	66	47	5
2	30	45	347.1	.30	444	.58	.58	220	240			51	81	68	48	5
1	35	50	349.9	.35	438	.68	.68	199	237			52	79	70	49	5
1	40	55	351.8	.35	445	.68	.68	250	244			49	77	70	48	5
E 4	45	1100	354.4	.40	449	.78	.78	420	257			53	76	70	49	5
4	50	5	356.7	.43	443	.85	.85	437	269			56	80	71	50	5
3	55	10	359.1	.40	444	.78	.78	439	270			57	80	72	49	5
3	60	15	361.6	.40	450	.78	.78	417	258			58	82	73	50	4
2	65	20	364.1	.40	444	.78	.78	342	258			58	84	74	50	4
2	70	25~~35~~	366.76	.40	450	.78	.78	253	251			52	85	75	46	4
1	75	30	368.53	.23	444	.44	.44	274	248			51	83	76	45	6

COMMENTS

A-51

FIELD DATA

PLANT Site 07
DATE 4-17-85
SAMPLING LOCATION Baghouse outlet
SAMPLE TYPE MMS
RUN NUMBER 07-MMS-02
OPERATOR Garcia - Henry
AMBIENT TEMPERATURE 50°F
BAROMETRIC PRESSURE 30.08
STATIC PRESSURE (P_s) -21.0" H2O
FILTER NUMBER (s) —
MINIMUM SAMPLE VOLUME 120 ft³

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PROBE LENGTH AND TYPE 4' Glass
NOZZLE I.D. .246
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 9E
METER BOX NUMBER 7
METER Δ H@ 1.85
C FACTOR .82
PROBE HEATER SETTING 250
HEATER BOX SETTING 250
REFERENCE Δp .95
DRY/GAS METER FACTOR (Y) .9955

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 5 MINUTES

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H2O	Stack T_s in °F	Orifice Pressure Differential (ΔH, in. H2O)		Temperature °F/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit	
									Skin	Out			Inlet (T_m in)	Outlet (T_m out)		
B-2-	190	1330	427.77													
B-1	195	35	429.68	.22	435	.42	.42	180	245	—	—	54	85	78	49	.5
1	200	40	431.63	.22	444	.42	.42	168	232	-	-	52	82	77	49	.5
A-4	205	45	434.17	.49	449	.58	.98	224	226	-	-	55	81	77	47	2
4	210	50	436.81	.45	450	.89	.89	398	258	-	-	56	83	76	47	2
3	215	55	439.3	.43	449	.86	.86	440	265	—	—	57	83	76	48	2
3	220	1400	442.1	.48	443	~~.48~~ .94	.94	435	264	-	—	58	85	76	48	2
2	225	05	444.6	.40	450	.78	.78	370	263	-	-	56	85	77	48	2
2	230	10	447.25	.43	450	.86	.86	250	253	-	-	57	84	77	48	2
1	235	15	449.32	.26	436	.51	.51	211	248	-	—	57	84	76	49	2
1	240	20	451.396	.28	442	.54	.54	196	240	-	—	57	84	76	49	2
	240		122.[illegible]4		446.08		.87						78.29			

COMMENTS

07-MMS-BO-2 page 3 of 3

STOP
LK CK ,017
START

Traverse Point Number	Sampling Time Min. 75	Clock Time (24-hr Clock) 1130	366.53 Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T_s, in °F	Orifice Pressure Differential (ΔH, in. H₂O) Desired	Orifice Pressure Differential (ΔH, in. H₂O) Actual	Temperature [✓ °F] °C (Circle One) Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	Pump Vacuum in. Hg
E-1	80	35	370.5	.24	445	.47	.47	186	236			53	82	77	46	0
D-4	85	40	372.9	.40	444	.80	.80	200	231	–	–	52	83	76	45	3
4	90	45	375.8	.54	453	1.1	1.1	366	242	–	–	50	83	77	46	3
3	95	50	378.48	.47	448	.93	.93	418	266	–	–	51	83	75	45	3
3	100	55	381.10	.45	447	.90	.90	430	264	–	–	50	84	76	45	3
2	105	1200	383.45	.35	447	.69	.69	330	262	–	–	51	85	78	46	3
2	110	05	385.86	.37	448	.73	.73	205	254	–	–	51	83	76	46	2
1	115	10	387.96	.37	450	.52	.52	190	250	–	–	51	82	77	46	2
1	120	15	390.196	.27	451	.52	.52	186	237	–	–	52	81	76	46	2
C·4	120	1220	390.415	LEAK CHECK				.017								
C-4	125	25	393.42	.61	455	1.2	1.2	182	232	–	–	57	78	76	49	3
4	130	30	396.47	.61	457	1.2	1.2	388	254	–	–	60	82	76	48	3
3	135	35	399.45	.61	452	1.2	1.2	424	271	–	–	59	84	76	48	3
3	140	40	402.19	.55	450	1.1	1.1	432	271	–	–	60	86	76	53	3
2	145	45	404.7	.40	448	.80	.80	319	267	–	–	59	88	78	48	3
2	150	50	407.4	.45	449	.90	.90	237	260	-	–	57	86	77	48	3
1	155	55	409.47	.27	445	.52	.52	205	252	-	–	52	86	78	49	2
1	160	1300	411.59	.29	445	.55	.55	211	243	–	–	52	84	78	48	2
B-4	165	05	414.19	.58	450	1.15	1.15	294	241	–	–	54	84	78	47	2
4	170	10	417.06	.55	455	1.1	1.1	399	262	–	–	55	86	77	47	2
3	175	15	420.14	.55	455	1.1	1.1	437	266	–	–	55	87	78	48	2
3	180	20	422.64	.52	438	1.05	1.05	422	263	–	–	56	88	78	49	3
2	185	25	425.16	.41	452	.82	.82	346	261	–	–	54	87	78	48	3
2	190	30	427.77	.44	448	.88	.88	209	244	–	–	54	86	78	49	3
TOTAL		●		●	●	●	●	●	●	●	●	●	●	●	●	●
AVERAGE	●	●	●	●		●		●	●	●	●	●			●	●

A-53

FIELD DATA

PLANT Site 07
DATE 4-18-85
SAMPLING LOCATION BAGHOUSE outlet
SAMPLE TYPE MM5
RUN NUMBER 07-MM5-BO-03
OPERATOR Henry Garcia
AMBIENT TEMPERATURE 50°F
BAROMETRIC PRESSURE 30.04 mcR
STATIC PRESSURE (P_s) -21.0" H2O
FILTER NUMBER (s) T
MINIMUM SAMPLE VOLUME 120 ft³
Initial leak ,020
Final leak ,015

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PROBE LENGTH AND TYPE 4' Glass
NOZZLE I.D. .246
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 9E
METER BOX NUMBER ~~10~~ 7
METER Δ H@ [redacted] 1.85
C FACTOR .82
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F
REFERENCE Δp .90
DRY/GAS METER FACTOR (Y) .9955

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 5 MINUTES

Traverse Point Number	Sampling Time Min. 0	Clock Time (24-hr Clock) 950	452.320 Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H_2O	Stack T_s, °F	Orifice Pressure Differential (ΔH, in. H_2O)		Temperature [✓ °F]/°C (Circle One)								Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter		Recirc. Water	Absorbent Trap	Dry Gas Meter		Impinger Exit	
									Skin	Out			Inlet (T_m in)	Outlet (T_m out)		
F-4	5	55	454.53	.45	424	.91	.91	303	252	-	—	51	69	70	50	3
4	10	1000	457.07	.45	425	.91	.91	401	248	-	-	51	72	70	48	2
3	15	05	459.96	.65	426	1.35	1.35	418	259	—	-	54	76	71	48	2
3	20	10	463.32	.66	427	1.4	1.4	426	272	—	—	55	79	70	49	4
2	25	15	466.30	.57	433	1.2	1.2	421	271	—	—	58	81	70	57	3
2	30	20	469.45	.62	426	1.3	1.3	358	269	—	—	49	83	71.	49	3
1	35	25	471.91	.28	425	.55	.55	194	274	—	-	48	82	71	51	2
1	40	30	474.25	.28	426	.55	.55	206	281	—	—	48	80	72	51	2
E-4	45	35	476.25	.40	428	.80	.80	193	278	—	—	48	80	72	50	2
4	50	40	478.70	.38	432	.78	.78	343	273	-	-	51	82	72	50	5
3	55	45	481.01	.35	433	.72	.72	386	276	-	-	52	82	72	51	3
3	60	50	483.68	.40	433	.80	.80	412	282	—	-	51	83	73	51	5
2	65	55	486.21	.45	433	.97	.97	359	284	-	—	50	84	74	51	5
2	70	1000	488.92	.45	433	.91	.91	195	285	-	-	50	85	74	51	8
1	75	05	491.22	.32	438	.66	.66	144	282	—	-	50	85	75	51	

COMMENTS

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07-MM5-BC-3 Page 2 of 3

	Traverse Point Number	Sampling Time Min. 75	Clock Time (24-hr Clock) 1005	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T_s, in °F	Orifice Pressure Differential (ΔH, in. H₂O) Desired	Orifice Pressure Differential (ΔH, in. H₂O) Actual	Temperature [✓ °F]/°C (Circle One) Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	Pump Vacuum in. Hg	
	E-1	80	10	493.73	.30	434	.60	.60	120	282	—	—	51	85	75	52	5	
STOP	D-4	82	18	495.20	~~.50~~	~~435~~	~~1.05~~	~~1.05~~	~~200~~	~~285~~	~~—~~	~~—~~	~~51~~	~~85~~	~~76~~	~~51~~	~~5~~	• No ∇ used to calculate M'R
START	4	82	1117	495.28	BROKEN U-TUBE (REPLACED) LEAK CHECK .005												2	
	4	85	20	496.25	.48	445	.99	.99	277	264	—	—	48	79	74	50	10	
	4	90	25	498.92	.44	443	.92	.92	323	271	—	—	49	81	75	51	8	
	3	95	30	501.46	.38	436	.78	.78	440	285	—	—	45	84	76	49	8	
	3	100	35	503.92	.37	445	.76	.76	402	287	—	—	49	84	77	51	8	
	2	105	40	506.11	.28	438	.56	.56	362	289	—	—	47	85	78	52	7	
	2	110	45	508.45	.30	439	.64	.64	196	296	—	—	49	85	79	53	7	
	1	115	50	510.47	.26	438	.52	.52	166	276	—	—	50	85	80	52	7	
	1	120	55	512.78	.25	441	.50	.50	162	263	—	—	49	85	80	52	7	
	C-4	125	1200	515.32	.62	440	1.3	1.3	263	282	—	—	51	89	83	52	10	
	4	130	05	518.33	.55	440	1.1	1.1	379	287	—	—	54	92	84	52	10	
	3	135	10	521.1	.48	442	.99	.99	392	290	—	—	53	94	84	53	10	
	3	140	15	~~[illegible]~~	.48	442	.99	.99	391	278	—	—	54	94	86	54	10	
	2	145	20	526.2	.30	441	.60	.60	345	276	—	—	54	92	86	54	10	
	2	150	25	528.7	.40	444	.84	.84	200	261	—	—	54	90	88	54	10	
	1	155	30	530.73	.20	438	.40	.40	160	251	—	—	53	89	87	51	7	
	1	160	35	532.77	.24	441	.50	.50	152	241	—	—	54	88	88	52	8	
	~~B-4~~	STOP																
START Leak Check	~~B-4~~	START	1312	533.260	PROBE SHORTED OUT (REPAIRED) LEAK CHECK .006													
	B-4	165	17	535.30	.45	446	.94	.94	354	236	—	—	58	75	71	52	10	
	4	170	22	537.90	.42	445	.87	.87	400	277	—	—	49	75	75	49	8	
	3	175	27	540.18	.41	443	.85	.85	400	274	—	—	50	78	75	50	8	
	TOTAL		●		●	●	●	●	●	●	●	●	●	●	●	●	●	
	AVERAGE	●	●	●	●		●		●	●	●	●	●			●	●	

FIELD DATA

PLANT Site 07
DATE 4-18-85
SAMPLING LOCATION BagHouse outlet
SAMPLE TYPE MM5
RUN NUMBER 07 MM5-BO-03
OPERATOR Garcia Henry
AMBIENT TEMPERATURE 50°F
BAROMETRIC PRESSURE 30.04
STATIC PRESSURE (P_s) -21.0"H2O
FILTER NUMBER (s) -
MINIMUM SAMPLE VOLUME 120 f³

PROBE LENGTH AND TYPE 4' Glass
NOZZLE I.D. .246
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 9E
METER BOX NUMBER 7
METER Δ H@ 1.85
C FACTOR .82
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F
REFERENCE Δp .90
DRY/GAS METER FACTOR (Y) .9955

Page 3 of 3

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 5 MINUTES

Traverse Point Number	Sampling Time Min. 175	Clock Time (24-hr Clock) 1327	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T in °F	Orifice Pressure Differential (ΔH, in. H₂O)		Temperature °F/°C (Circle One)								
						Desired	Actual	Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Dry Gas Meter Inlet (T_m in)	Dry Gas Meter Outlet (T_m out)	Impinger Exit	Pump Vacuum in. Hg
B-3	180	32	542.91	.36	434	.74	.74	464	255	—	—	48	81	75	52	8
2	185	37	545.16	.29	438	.59	.59	349	243	—	—	49	81	75	54	8
2	190	42	547.28	.29	438	.59	.59	235	234	—	—	46	77	74	52	8
1	195	47	549.15	.18	434	.36	.36	205	224	—	—	46	75	72	54	4
1	200	52	550.76	.18	427	.36	.36	196	217	—	—	46	76	71	50	4
A-4	205	57	552.4	.23	436	.44	.44	248	211	—	—	46	77	71	49	5
4	210	1402	554.55	.23	432	.44	.44	438	230	—	—	50	79	71	50	5
3	215	07	556.83	.28	435	.56	.56	460	245	—	—	48	80	72	51	8
3	220	12	558.9	.38	436	.76	.76	451	246	—	—	49	83	73	51	8
2	225	17	561.4	.38	429	.76	.76	388	247			49	85	73	53	8
2	230	22	563.8	.38	436	.76	.76	270	244			48	86	74	50	8
1	235	27	566.1	.31	427	.64	.64	201	234			50	84	75	54	7
1	240	32	568.335	.31	429	.64	.64	210	230			47	86	75	54	7

COMMENTS 115. 435.39 .77 79.07

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BAGHOUSE OUTLET

HCL RUN SHEETS

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PRE POST

MODIFIED METHOD 5 DATA

PLANT Site 07
DATE 4- -85
SAMPLING LOCATION outlet
SAMPLE TYPE HCL
RUN NUMBER 07-HCL-1
OPERATOR Henry - Garcia
AMBIENT TEMPERATURE 55°F
BAROMETRIC PRESSURE 29.98
STATIC PRESSURE (P_s) -01.0
FILTER NUMBER (s) —
MINIMUM SAMPLE VOLUME
INITIAL LEAK CHECK .015

PROBE LENGTH AND TYPE 2' GLASS
NOZZLE I.D. .249
ASSUMED MOISTURE, % [redacted] 12%
SAMPLE BOX NUMBER [redacted]
METER BOX NUMBER 10
METER Δ H@ 1.74
C FACTOR .82
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F
REFERENCE Δp .96
DRY/GAS METER FACTOR (Y) .9993
FINAL LEAK CHECK .012

SCHEMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA EVERY 10 MINUTES

Traverse Point Number	Sampling Time Min.	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H₂O	Stack T_s, °F	Orifice Pressure Differential (ΔH, in. H₂O)		Temperature °F/°C (Circle One)					Dry Gas Meter			Pump Vacuum in. Hg
						Desired	Actual	Probe	Filter Skin	Filter Out	Recirc. Water	Absorbent Trap	Inlet ($T_{m\ in}$)	Outlet ($T_{m\ out}$)	Impinger Exit	
		1460	411.845													
A-2	10	1508	416.30	.42	414	.85	.85	241	241	—	—	—	60	60	46	2
	20	19	421.33	.37	416	.74	.74	—	263	—	—	—	68	61	46	2
	30	29	426.35	.37	417	.74	.74	—	277	—	—	—	74	65	48	2
	40	39	431.12	.32	419	.65	.65	—	277	—	—	—	78	68	50	2
	50	49	435.94	.30	417	.60	.60	—	269	—	—	—	82	73	53	2
	60	59	440.650	.35	417	.71	.71	—	264	—	—	—	84	74	53	2
	70	1609	445.93	.37	417	.74	.74	—	280	—	—	—	86	77	54	2
	80	19	451.00	.37	417	.74	.74	—	261	—	—	—	86	77	55	2
	90	29	456.10	.37	418	.74	.74	—	266	—	—	—	88	75	55	2
	100	39	461.56	.40	419	.82	.82	—	265	—	—	—	86	78	55	2
	110	49	466.78	.40	417	.82	.82	—	271	—	—	—	86	79	56	2
	120	59	471.741	.35	416	.71	.71	—	261	—	—	—	86	79	56	2
	120		59.896		417.17		.74						76.2			

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COMMENTS

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FIELD DATA

PLANT Site 07
DATE 4/15/85
SAMPLING LOCATION baghouse outlet
SAMPLE TYPE HCl
RUN NUMBER 07-HCL-02
OPERATOR flc gdk
AMBIENT TEMPERATURE 57
BAROMETRIC PRESSURE 30.01"
STATIC PRESSURE, (P_s) -.31"
FILTER NUMBER (s) –
Int. LK CK .015
Final LKCK .005

PROBE LENGTH AND TYPE 2' glass
NOZZLE I.D. .249
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER –
METER BOX NUMBER 10
METER $\Delta H_@$ 1.74
C FACTOR .55
PROBE HEATER SETTING 250°
HEATER BOX SETTING 250°
REFERENCE Δp .95
Y: .9993

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 10 MINUTES

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
					DESIRED	ACTUAL		INLET $(T_{m_{in}})$, °F	OUTLET $(T_{m_{out}})$, °F			
Single Pt	0	1023	473.216 ~~473.018~~									
	10	1033	479.5	.55	1.1	1.1	410	55	53	4	224	49
	20	43	485.4	.45	.9	.9	428	69	56	4	240	51
	30	53	490.9	.45	.9	.9	436	75	62	4	239	60
	40	1103	496.3	.45	.9	.9	438	77	65	4	239	63
	50	1113	501.4	.40	.8	.8	436	80	68	4	240	63
	60	23	506.42	.37	.74	.74	436	83	71	4	240	62
	70	33	512.40	.45	.90	.90	440	84	73	4	244	57
	80	43	518.10	.45	.90	.90	442	85	75	4	261	57
	90	53	523.59	.45	.90	.90	443	84	75	4	254	58
	100	1203	529.10	.45	.90	.90	442	85	75	4	250	58
	110	13	534.58	.43	.87	.87	443	83	76	4	252	59
	120	23	540.060	.43	.87	.87	447	85	76	4	255	60
	End of Test											
	120		66.844			0.89	436.75	73.75				

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COMMENTS:

EPA (Dur) 235

FIELD DATA

PLANT Site 07
DATE 4-18-85
SAMPLING LOCATION BAGHouse outlet
SAMPLE TYPE HCL
RUN NUMBER 07-HCL-00-03
OPERATOR Garcia - Henry
AMBIENT TEMPERATURE 50°F
BAROMETRIC PRESSURE 30.04 "Hg
STATIC PRESSURE, (P_s) -21.0" H2O
FILTER NUMBER (s) –
Init leak .015
Final .005

PROBE LENGTH AND TYPE 2' Glass
NOZZLE I.D. .249
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER
METER BOX NUMBER 10
METER ΔH@ 1.74
C FACTOR .85
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F
REFERENCE Δp .53
Factor .9993

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 10 MINUTES

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
Single point	0	958	541.185									
STOP	10	1008	545.823	.35	.69	.69	370	70	68	4	200	49
START	~~10~~ 10	1026	546.80	NO	BOX	HEAT	(REPLACED		BOX)			
	20	36	550.17	.27	.54	.54	387	72	70	4	236	48
	30	46	554.52	.27	.54	.54	388	79	71	3	180	45
	40	56	558.90	.25	.51	.51	416	81	71	3	178	47
	50	1106	562.67	.23	.44	.44	418	82	72	3	203	49
	60	16	566.60	.27	.54	.54	420	81	72	3	214	49
	70	26	571.12	.20	.41	.41	418	80	73	3	206	49
	80	36	574.98	.25	.51	.51	421	81	74	3	197	51
	90	46	579.14	.23	.45	.45	419	80	73	3	207	52
	100	56	583.64	.23	.45	.45	420	78	71	3	203	52
	110	1206	587.06	.23	.45	.45	422	81	72	3	191	52
	120	16	591.308	.30	.59	.57	425	81	72		140	52
								✓				
			49.946			.51	410.5	75.2				

COMMENTS:

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EPA (Dur) 235

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BAGHOUSE INLET

MM5 RECOVERY SHEETS

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PLANT . Site 07
DATE 4/15/85
SAMPLING LOCATION INLET
SAMPLE TYPE MM5
RUN NUMBER 1 07-MM5-BI-1
SAMPLE BOX NUMBER ______
CLEAN-UP PERSON arg
SOLVENT RINSES Acetone (3X) MeCl$_2$ (3X)

COMMENTS:

FRONT HALF - PARTICULATE PHASE

SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ______		**GRAVIMETRIC RESULTS**	**LABORATORY RESULTS**
		FINAL:	______ mg	
		TARE:	______ mg	
		NET:	______ mg	___,______ µg
FILTER NUMBER ______ ______ ______ ______ ______ ______	CONTAINER # ______	FINAL:	______ mg	
		TARE:	______ mg	
		NET:	______ mg	______ µg
		FRONT HALF SUBTOTAL	______ mg	______ µg

ORGANIC-VAPOR PHASE

TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ______	Initial	final	______ µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # 5	360.9 grams	366.8 g	______ µg
IMPINGER NO.1 (QA)	CONTAINER #4 ______	NET GAIN ______ (See Impinger Results Reverse Side)		______ µg
			TOTAL	______ µg

NOTES/OBSERVATIONS:

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② changed impinger - insert too long

ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-MM5-BI-01 Sampling Date 4/16/85 Recovery Date 4/16/85 4/17/85

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration		Weight (grams)
1*	empty	0		Final	767.8 ①
				Initial	~~[illegible]~~ 419.1
				Wt. gain	348.7
2	HPLC Water	100 ml		Final	539.1
				Initial	~~[illegible]~~ 549.6
				Wt. gain	-10.5
3	HPLC Water	100 ml		Final	560.0
				Initial	563.1
				Wt. gain	-3.1
4	empty	0		Final	513.6
				Initial	② 511.3 ~~[illegible]~~ ~~[illegible]~~
				Wt. gain	2.3
5	Silica gel	200 grams		Final	723.3
				Initial	685.5
				Wt. gain	37.8
6				Final	
				Initial	
				Wt. gain	
7				Final	
				Initial	
				Wt. gain	

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TOTAL WEIGHT GAIN OF IMPINGERS (grams) 375.2 ✓

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

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PLANT S.Ve 07

DATE 4/16/85

SAMPLING LOCATION INLET

SAMPLE TYPE MM5

RUN NUMBER 2

SAMPLE BOX NUMBER

CLEAN-UP PERSON cwg

SOLVENT RINSES Acetone (3x) $MeCl_2$ (3x)

COMMENTS:

FRONT HALF - PARTICULATE PHASE

		GRAVIMETRIC RESULTS	LABORATORY RESULTS
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER #	FINAL: mg	
		TARE: mg	
		NET: mg	µg
FILTER NUMBER	CONTAINER #	FINAL: mg	
		TARE: mg	
		NET: mg	µg
		FRONT HALF SUBTOTAL mg	µg

ORGANIC-VAPOR PHASE

		initial	final	
TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER #		370.9	µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # 19	367.0 grams	~~[illegible]~~	µg
IMPINGER NO.1 (QA)	CONTAINER #4	NET GAIN (See Impinger Results Reverse Side)		µg
			TOTAL	µg

NOTES/OBSERVATIONS:

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ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-MM5-BI-02 Sampling Date 4/17/85

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration		Weight (grams)
1*	empty	0		Final Initial Wt. gain	801.0 815.2 ~~[illegible]~~ 429.0 379.0 0
2	HPLC Water	100 ml		Final Initial Wt. gain	587.9 589.1 2.8
3	HPLC Water	100 ml		Final Initial Wt. gain	571.6 571.3 .3
4	empty	0		Final Initial Wt. gain	527.0 525.7 1.3
5	Silicia Gel	200 grams		Final Initial Wt. gain	731.0 694.0 32.0
6	Trap#19			Final Initial Wt. gain	370.9 367.0 3.9
7				Final Initial Wt. gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 410.05 ✓

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

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ORGANIC SAMPLING TRAIN RECOVERY SHEET

PLANT SITE 07

DATE 4/17/85

SAMPLING LOCATION Inlet

SAMPLE TYPE MM5

RUN NUMBER 03 07-MM5-BI-3

SAMPLE BOX NUMBER ______

CLEAN-UP PERSON Cody

SOLVENT RINSES Acetone(3X) MeCl2(3X)

COMMENTS:

FRONT HALF - PARTICULATE PHASE

		GRAVIMETRIC RESULTS	LABORATORY RESULTS
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ______	FINAL: ______ mg TARE: ______ mg NET: ______ mg	______ µg
FILTER NUMBER ______ ______ ______ ______ ______ ______	CONTAINER # ______	FINAL: ______ mg TARE: ______ mg NET: ______ mg	______ µg
		FRONT HALF SUBTOTAL ______ mg	______ µg

ORGANIC-VAPOR PHASE

TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ______	Initial Final	______ µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # 2	365.3 364.2	______ µg
IMPINGER NO.1 (QA)	CONTAINER #4 ______	NET GAIN ______ (See Impinger Results Reverse Side)	______ µg
		TOTAL	______ µg

NOTES/OBSERVATIONS:

ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-MM5-BI-03 Date

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration		Weight (grams)
1*	empty	0		Final	760.0
				Initial	429.5
				Wt. gain	330.5
2	HPLC H_2O	100 ml		Final	592.7
				Initial	~~50~~ 591.3
				Wt. gain	1.4
3	HPLC H_2O	100 ml		Final	572.6
				Initial	572.3
				Wt. gain	0.3
4	empty	0		Final	527.0
				Initial	526.7
				Wt. gain	0.3
5	Silica Gel	200 g		Final	718.6
				Initial	692.5
				Wt. gain	26.1
6				Final	
				Initial	
				Wt. gain	
7				Final	
				Initial	
				Wt. gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 358.6 ✓

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

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BAGHOUSE OUTLET

MM5 RECOVERY SHEETS

ORGANIC SAMPLING TRAIN RECOVERY SHEET

PLANT SITE07

DATE 4/15/85

SAMPLING LOCATION MM5 Outlet

SAMPLE TYPE MM5

RUN NUMBER 1 07-MM5-BO-1

SAMPLE BOX NUMBER ____

CLEAN-UP PERSON CKG

SOLVENT RINSES Acetone (3X) MeCl$_2$ (3X)

COMMENTS:

FRONT HALF - PARTICULATE PHASE		**GRAVIMETRIC RESULTS**	**LABORATORY RESULTS**
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ____	FINAL: ____ mg	
		TARE: ____ mg	
		NET: ____ mg	____ µg
FILTER NUMBER ____ ____	CONTAINER # ____	FINAL: ____ mg	
____ ____		TARE: ____ mg	
____ ____		NET: ____ mg	____ µg
		FRONT HALF SUBTOTAL ____ mg	____ µg
ORGANIC-VAPOR PHASE			
TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ____	initial final	____ µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # 12	365.7 grams w/ caps 371.5	____ µg
IMPINGER NO.1 (QA)	CONTAINER #4 ____	NET GAIN ____ (See Impinger Results Reverse Side)	____ µg
			TOTAL ____ µg

NOTES/OBSERVATIONS:

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ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-MM5-BO-01 Date 4/10/85

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration		Weight (grams)	REWEIGHED AFTER WATER SUCKED BACK
1*	empty	0		Final	744.0	
				Initial	510.0	514.3 455.1
				Wt. gain		288.9
2	HPLC Water	100 ml		Final	604.0	
				Initial	582.4	609.8
				Wt. gain		5.8
3	HPLC Water	100 ml		Final	487.7	
				Initial	550.0	486.6
				Wt. gain		1.1
4	empty	0		Final	475.8	
				Initial	475.0	same
				Wt. gain	.8	
5	Silica gel	200g		Final	723.6	
				Initial	697.7	
				Wt. gain	25.9	
6				Final		
				Initial		
				Wt. gain		
7				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 310.9 ✓

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

PLANT SiTe 07

COMMENTS:

DATE 4/16/85

SAMPLING LOCATION OUTLET

SAMPLE TYPE MM5

RUN NUMBER 2 C7-MM5-BO-2

SAMPLE BOX NUMBER ____

CLEAN-UP PERSON Cay

SOLVENT RINSES Acetone (3X) MeCl$_2$ (3X)

		GRAVIMETRIC RESULTS	LABORATORY RESULTS
FRONT HALF - PARTICULATE PHASE			
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ____	FINAL: ____ mg	
		TARE: ____ mg	
		NET: ____ mg	____ µg
FILTER NUMBER ____ ____ ____ ____ ____ ____	CONTAINER # ____	FINAL: ____ mg	
		TARE: ____ mg	
		NET: ____ mg	____ µg
		FRONT HALF SUBTOTAL ____ mg	____ µg
ORGANIC-VAPOR PHASE			
TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ____	initial Final	____ µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # 15	376.7 grams 379.6	____ µg
IMPINGER NO.1 (QA)	CONTAINER #4 ____	NET GAIN ____ (See Impinger Results Reverse Side)	____ µg
			TOTAL ____ µg

NOTES/OBSERVATIONS:

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ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 67-MM5-BO-02 Sampling ~~Date~~ Date 4/17/85

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration	Weight (grams)
1*	empty	0		Final 793.4 Initial 454.8 Wt. gain 338.6
2	HPLC Water	100 ml		Final 591.0 Initial 588.6 Wt. gain +2.4
3	HPLC WATER	100 ml		Final 577.0 Initial 577.3 Wt. gain -.3
4	EMPTY	0		Final 486.8 Initial 485.3 Wt. gain 1.5
5	SILICA GEL	200 grams		Final 755.3 Initial 734.0 Wt. gain 21.3
6				Final Initial Wt. gain
7	TRAP # 15			Final 379.6 Initial 376.4 Wt. gain +3.2

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 366.7 g

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

ORGANIC SAMPLING TRAIN RECOVERY SHEET

PLANT Site 07

DATE 4/18/85

SAMPLING LOCATION OUTLET

SAMPLE TYPE MM5

RUN NUMBER 03 07-MM5-B0-3

SAMPLE BOX NUMBER

CLEAN-UP PERSON Caf

SOLVENT RINSES Acetone(3X) MeCl2(3X)

COMMENTS:

FRONT HALF - PARTICULATE PHASE

			GRAVIMETRIC RESULTS	LABORATORY RESULTS
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER		CONTAINER #	FINAL: mg	
			TARE: mg	
			NET: mg	µg
FILTER NUMBER		CONTAINER #	FINAL: mg	
			TARE: mg	
			NET: mg	µg
			FRONT HALF SUBTOTAL mg	µg

ORGANIC-VAPOR PHASE

				LABORATORY RESULTS
TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER #			µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # 6	initial 346.8	final 355.0	µg
IMPINGER NO.1 (QA)	CONTAINER #4	NET GAIN (See Impinger Results Reverse Side)		µg
			TOTAL	µg

NOTES/OBSERVATIONS:

ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-MM5-BO-03 Date ____

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration		Weight (grams)
1*	empty	0		Final	646.9
				Initial	455.1
				Wt. gain	191.8
2	HPLC H_2O	100 ml		Final	595.1
				Initial	~~578.4~~ 592.2
				Wt. gain	2.9
3	HPLC H_2O	100 ml		Final	577.7
				Initial	578.9
				Wt. gain	~~-0.2~~ -1.2 mER
4	empty	0		Final	487.6
				Initial	486.4
				Wt. gain	1.2 ✓
5	Silica Gel	200 g		Final	756.1
				Initial	733.1
				Wt. gain	23.0
6	Trap			Final	355.0
				Initial	346.8
				Wt. gain	8.2
7				Final	
				Initial	
				Wt. gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) ~~226.3~~ 225.9

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

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BAGHOUSE OUTLET

HCL RECOVERY SHEETS

HCl ~~[illegible]~~ SAMPLING TRAIN RECOVERY SHEET

PLANT Site 07

DATE 4/15/85

SAMPLING LOCATION OUTLET

SAMPLE TYPE HCL

RUN NUMBER 1 07-HCL-BO-1

SAMPLE BOX NUMBER ____

CLEAN-UP PERSON CL4

SOLVENT RINSES KOH (3X) HPLC water (3X)

COMMENTS:

A-85

FRONT HALF - PARTICULATE PHASE

		GRAVIMETRIC RESULTS	LABORATORY RESULTS
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ____	FINAL: ____ mg	
		TARE: ____ mg	
		NET: ____ mg	____ µg
FILTER NUMBER ____ ____ ____ ____ ____ ____	CONTAINER # ____	FINAL: ____ mg	
		TARE: ____ mg	
		NET: ____ mg	____ µg
		FRONT HALF SUBTOTAL ____ mg	____ µg

ORGANIC-VAPOR PHASE

TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ____		____ µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # ____		____ µg
IMPINGER NO.1 (QA)	CONTAINER #4 ____	NET GAIN ____ (See Impinger Results Reverse Side)	____ µg
			TOTAL ____ µg

NOTES/OBSERVATIONS:

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[illegible] weigh 2nd impinger. ∴ condensate plus 1st impinger rinse = 907.4 - 374.4 = 533.

See attached sheet for estimate of weight gain - use MMS for moisture content

ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07- HCL- BO-01 Date 4/16/85

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration		Weight (grams)
1*	KOH	~150 ml	Modified	Final	716.2
				Initial	628.4
				Wt. gain	87.8
2	KOH	~150 ml	Modified	Final	
				Initial	659.6
				Wt. gain	estimated at 86.3*
3	Empty	0	Modified	Final	497.7
				Initial	489.5
				Wt. gain	8.2
4	Silca Gel	~200 grams	Silica Gel	Final	713.8
				Initial	698.3
				Wt. gain	15.5
5				Final	
				Initial	
				Wt. gain	
6				Final	
				Initial	
				Wt. gain	
7				Final	
				Initial	
				Wt. gain	

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TOTAL WEIGHT GAIN OF IMPINGERS (grams) * 197.8

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

Run [illegible]

Empty weight of	1st	2nd	3rd	impinger
	477.5	493.2	489.5	
final weight	716.2	?	497.7	
total condensate + initial	238.7	?	8.2	
KOH initially	150.9	166.4	0	

533.2 − 238.7 − 8.2 = 286.3 } rinse + 2nd impinger

−150 KOH

136.3

−~50 ml rinses

~86.3 wt gain

PLANT ____

DATE 4/16/85

SAMPLING LOCATION OUTLET

SAMPLE TYPE HCL

RUN NUMBER 2 07-HCL-BO-2

SAMPLE BOX NUMBER ____

CLEAN-UP PERSON Cmy

SOLVENT RINSES KOH (3X) HPLC Water (3X)

COMMENTS:

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		GRAVIMETRIC RESULTS	LABORATORY RESULTS
FRONT HALF - PARTICULATE PHASE			
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ____	FINAL: ____ mg	
		TARE: ____ mg	
		NET: ____ mg	____ μg
FILTER NUMBER ____ ____ ____ ____ ____ ____	CONTAINER # ____	FINAL: ____ mg	
		TARE: ____ mg	
		NET: ____ mg	____ μg
		FRONT HALF SUBTOTAL ____ mg	____ μg
ORGANIC-VAPOR PHASE			
TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ____		____ μg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # ____		____ μg
IMPINGER NO.1 (QA)	CONTAINER #4 ____	NET GAIN ____ (See Impinger Results Reverse Side)	____ μg
			TOTAL ____ μg

NOTES/OBSERVATIONS:

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ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-HCL-80-02 Date 4/17/85

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration	Weight (grams)
1*	KOH	150 ml	MOD.	Final 782.4 Initial ~~[illegible]~~ 635.8 Wt. gain 146.6
2	KOH	150 ml	ST	Final 720.8 Initial 684.9 Wt. gain 35.9
3	empty	0	ST	Final 445.2 Initial 440.0 Wt. gain 5.2
4	Silica Gel	200 grams	ST	Final 717.0 Initial ~~694.7~~ 696.0 Wt. gain 21.0
5				Final Initial Wt. gain
6				Final Initial Wt. gain
7				Final Initial Wt. gain

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 208.7✓

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

ORGANIC SAMPLING TRAIN RECOVERY SHEET

PLANT Site 07

DATE 4/18/85

SAMPLING LOCATION BAGHOUSE outlet

SAMPLE TYPE HCl

RUN NUMBER 07-HCL-BO-03

SAMPLE BOX NUMBER ________

CLEAN-UP PERSON Henry

SOLVENT RINSES KOH

COMMENTS:

		GRAVIMETRIC RESULTS	LABORATORY RESULTS
FRONT HALF - PARTICULATE PHASE			
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ____	FINAL: ____ mg	
		TARE: ____ mg	
		NET: ____ mg	____ μg
FILTER NUMBER ____ ____	CONTAINER # ____	FINAL: ____ mg	
____ ____		TARE: ____ mg	
____ ____		NET: ____ mg	____ μg
	FRONT HALF SUBTOTAL	____ mg	____ μg
ORGANIC-VAPOR PHASE			
TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ____		____ μg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # ____		____ μg
IMPINGER NO.1 (QA)	CONTAINER #4 ____	NET GAIN ____ (See Impinger Results Reverse Side)	____ μg
			TOTAL ____ μg

NOTES/OBSERVATIONS:

ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-HCL-BO-03 Date 4/18/85

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration	Weight (grams)	
1*	KOH	150.01		Final	736.2
				Initial	639.0
				Wt. gain	97.2
2	'KOH	150.20		Final	700.5
				Initial	688.8
				Wt. gain	11.7
3	Empty	Empty		Final	444.3
				Initial	442.8
				Wt. gain	1.5
4	SelicaGel	204.2		Final	713.1
				Initial	703.3
				Wt. gain	9.8
5				Final	
				Initial	
				Wt. gain	
6				Final	
				Initial	
				Wt. gain	
7				Final	
				Initial	
				Wt. gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 120,20 ✓

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

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RECOVERY SHEETS

FOR TRAIN BLANKS

PLAN ____________

DATE 4/16/85

SAMPLING LOCATION Blank/Outlet

SAMPLE TYPE MM15

RUN NUMBER Blank

SAMPLE BOX NUMBER ____________

CLEAN-UP PERSON Cxg

SOLVENT RINSES Acetone (3X) MeCl2 (3X)

COMMENTS:

FRONT HALF - PARTICULATE PHASE

		GRAVIMETRIC RESULTS	LABORATORY RESULTS
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ______	FINAL: ______ mg	
		TARE: ______ mg	
		NET: ______ mg	______ μg
FILTER NUMBER ______ ______ ______ ______ ______ ______	CONTAINER # ______	FINAL: ______ mg	
		TARE: ______ mg	
		NET: ______ mg	______ μg
		FRONT HALF SUBTOTAL ______ mg	______ μg

ORGANIC-VAPOR PHASE

TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ______	initial final	______ μg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # 3	368.3 g 368.8 g	______ μg
IMPINGER NO.1 (QA)	CONTAINER #4 ______	NET GAIN ______ (See Impinger Results Reverse Side)	______ μg
			TOTAL ______ μg

NOTES/OBSERVATIONS: BLANK PERFORMED ON [illegible] Rw 1st RUN TRAIN

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ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. OM-MM5 - BLANK - BO Date ____

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration		Weight (grams) EA
1*	empty	0		Final	456.0
				Initial	459.6
				Wt. gain	
2	HPLC Water	100 ml		Final	585.7
				Initial	585.6
				Wt. gain	
3	HPLC Water	100 ml		Final	
				Initial	551.9
				Wt. gain	
4	empty	0		Final	
				Initial	475.6
				Wt. gain	
5	Silica gel	200 g		Final	
				Initial	~~696.7~~ 692.7
				Wt. gain	
6				Final	
				Initial	
				Wt. gain	
7				Final	
				Initial	
				Wt. gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) D

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

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ORGANIC SAMPLING TRAIN RECOVERY SHEET

PLANT Simpson Timber

DATE 4/17/85

SAMPLING LOCATION Inlet

SAMPLE TYPE MM5

RUN NUMBER BLANK

SAMPLE BOX NUMBER ______

CLEAN-UP PERSON Cag

SOLVENT RINSES Acetone (3X) $MeCl_2$ (3X)

COMMENTS:

FRONT HALF - PARTICULATE PHASE

		GRAVIMETRIC RESULTS	LABORATORY RESULTS
SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ______	FINAL: ______ mg	
		TARE: ______ mg	
		NET: ______ mg	______ µg
FILTER NUMBER ______ ______ ______ ______ ______ ______	CONTAINER # ______	FINAL: ______ mg	
		TARE: ______ mg	
		NET: ______ mg	______ µg
		FRONT HALF SUBTOTAL ______ mg	______ µg

ORGANIC-VAPOR PHASE

TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # ______	initial final	______ µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # 7	366.7g 367.8	______ µg
IMPINGER NO.1 (QA)	CONTAINER #4 ______	NET GAIN ______ (See Impinger Results Reverse Side)	______ µg
			TOTAL ______ µg

NOTES/OBSERVATIONS: Recovered TRAIN FOR Run 01

ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-MM5-BI-BLANK Date ____

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration	Weight (grams)
1*	empty	0		Final Initial 420.0 Wt. gain
2	HPLC WATER	100 ml		Final Initial 548.3 Wt. gain
3	HPLC WATER	100 ml		Final Initial 565.3 Wt. gain
4	EMPTY	0		Final Initial 510.7 Wt. gain
5	SILICA GEL	200 g		Final Initial 692.6 Wt. gain
6				Final Initial Wt. gain
7				Final Initial Wt. gain

TOTAL WEIGHT GAIN OF IMPINGERS (grams) ____

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

PLANT SIMPSON TIMBER

DATE 4/16/85

SAMPLING LOCATION Blank

SAMPLE TYPE HCL

RUN NUMBER ______

SAMPLE BOX NUMBER ______

CLEAN-UP PERSON CLG

SOLVENT RINSES ~~Acetone~~ → KOH (3X) ~~HPLC Water (3X)~~

COMMENTS:

FRONT HALF - PARTICULATE PHASE

SOLVENT WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER # ______	**GRAVIMETRIC RESULTS**		**LABORATORY RESULTS**
		FINAL: ______ mg		
		TARE: ______ mg		
		NET: ______ mg		______ µg
FILTER NUMBER NA ______ ______, ______ ______ ______	CONTAINER # ______	FINAL: ______ mg		
		TARE: ______ mg		
		NET: ______ mg		______ µg
		FRONT HALF SUBTOTAL ______ mg		______ µg

ORGANIC-VAPOR PHASE

TRANSFER LINE AND CONDENSER (SOLVENT RINSE)	CONTAINER # NA		______ µg
RESIN TRAP (XAD-2) (NOTE): CAP & LABEL IMMEDIATELY	TRAP # NA		______ µg
IMPINGER NO.1 (QA)	CONTAINER #4 ______	NET GAIN ______ (See Impinger Results Reverse Side)	______ µg
			TOTAL ______ µg

NOTES/OBSERVATIONS: BLANK PERFORMED ON 1st RUN TRAIN
RECOVERED BY RFI 4/18/85 KOH ONLY

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ORGANIC SAMPLING TRAIN IMPINGER RECOVERY SHEET

Sample Code Ident. 07-HCL-BLANK Date

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration	Weight (grams)	
1*	KOH	150		Final	
				Initial	626.7
				Wt. gain	
2	KOH	150		Final	
				Initial	644.0
				Wt. gain	
3	empty	0		Final	
				Initial	491.4
				Wt. gain	
4	Silica gel	200 grams		Final	
				Initial	
				Wt. gain	
5				Final	
				Initial	
				Wt. gain	
6				Final	
				Initial	
				Wt. gain	
7				Final	
				Initial	
				Wt. gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) ____

*QA SAMPLE FOR ORGANIC COLLECTION EFFICIENCY - SAVE IN CONTAINER #4.

Samples for Further Analysis:

Sample No.	Description	Species	Results (Total mg.)

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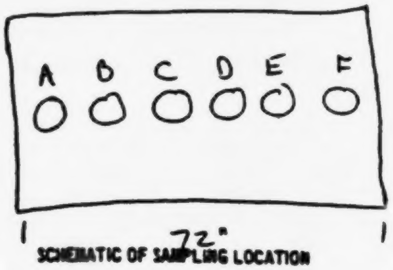
PRELIMINARY TESTING DATA

EPA METHOD 1

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Site 07
DATE 4-16-85
SAMPLING LOCATION OUTlet
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 66½"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 7"
STACK I.D., (DISTANCE A - DISTANCE B) 59" x 72
NEAREST UPSTREAM DISTURBANCE .5
NEAREST DOWNSTREAM DISTURBANCE 2
CALCULATOR HENRY



SCHEMATIC OF SAMPLING LOCATION

① RectANGUIAR STACK(DUCT)

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1		59x72		7"	14.5
2		59x72		7"	29.5
3		59x72		7"	44.5
4		59x72		7"	59.5

EPA (Dur) 232
4/72

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PRELIMINARY VELOCITY TRAVERSE

PLANT Site 07 07-MM5-B0
DATE 4-16-85
LOCATION Outlet
STACK I.D. 59" x 72 ncR
BAROMETRIC PRESSURE, in. Hg 29.98
STACK GAUGE PRESSURE, in. H_2O -21.0" H_2O
OPERATORS HENRY, GARCIA

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
F - 1	.29	404
2	.65	407
3	.71	409
4	.55	406
E - 1	.21	400
2	.32	404
3	.44	407
4	.62	408
D - 1	.25	387
2	.35	406
3	.38	407
4	.53	408
C - 1	.18	392
2	.37	403
3	.48	405
4	.50	405
B - 1	.17	390
2	.38	400
3	.50	402
4	.54	403
A - 1	.23	395
2	.33	398
3	.46	400
4	.50	402
AVERAGE		

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
AVERAGE		

EPA (Dur) 233
4 72

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CORPORATION

EPA METHODS 1-4, 5

NOMOGRAPH DATA

PLANT Site 07 07-MM5-B0

DATE 4-16-85

SAMPLING LOCATION outlet (MM5)

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.85
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	80
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	12%
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.98
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073 \times$ STACK GAUGE PRESSURE in in. H_2O)	P_s	-21" H_2O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	.947
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	~405
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	~.43
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	.71
C FACTOR	.82	
CALCULATED NOZZLE DIAMETER, in.	.250	
ACTUAL NOZZLE DIAMETER, in.	.246	
REFERENCE Δp, in. H_2O	.96	

EPA (Dur) 234
4 72

RADIAN
CORPORATION

EPA METHODS 1-4, 5

NOMOGRAPH DATA

PLANT Site 07 07-HCL-B0

DATE 4/16/85

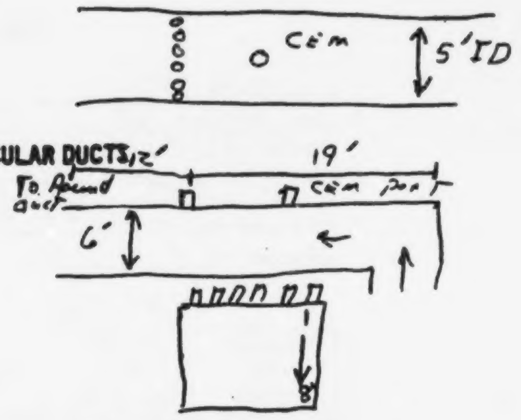
SAMPLING LOCATION Outlet (HCL)

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.74
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	80
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	12
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.98
STATIC PRESSURE IN STACK, in. Hg (P_m ± 0.073 x STACK GAUGE PRESSURE in in. H_2O)	P_s	-21.0" H_2O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	.946
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	405
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	.43
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	.71
C FACTOR	.85	
CALCULATED NOZZLE DIAMETER, in.	.250	
ACTUAL NOZZLE DIAMETER, in.	.249	
REFERENCE Δp, in. H_2O	.90	

EPA (Dur) 234
4 72

EPA METHOD 1

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS



SCHEMATIC OF SAMPLING LOCATION

PLANT Site 07
DATE 4-16
SAMPLING LOCATION Baghouse Inlet
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 78½"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 6½"
STACK I.D., (DISTANCE A - DISTANCE B) 72" x 60"
NEAREST UPSTREAM DISTURBANCE ≈ 156"
NEAREST DOWNSTREAM DISTURBANCE 144"
CALCULATOR McReynolds

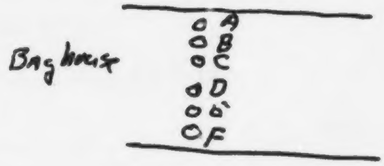
07-MMS-BI

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	1/16	72	4.5	6½	11
2	3/16	↓	13.5	↓	20
3	5/16		22.5		29
4	7/16		31.5		38
5	9/16		40.5		47
6	11/16		49.5		56
7	13/16		58.5		65
8	15/16		67.5		74

EPA (Dur) 232
4/72

PRELIMINARY VELOCITY TRAVERSE

PLANT Site 07
DATE 4-16-85
LOCATION Baghouse Inlet
STACK I.D. 72" x 66.3 ID
BAROMETRIC PRESSURE, in. Hg 29.98
STACK GAUGE PRESSURE, in. H_2O -4.9
OPERATORS McR GDH LG



SCHEMATIC OF TRAVERSE POINT LAYOUT

07-MMS-BI

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
A-1	.35	371
2	.35	379
3	.35	401
4	.35	416
5	.34	423
6	.35	439
7	.35	451
8	.34	455
B-1	.39	342
2	.38	407
3	.38	417
4	.37	427
5	.~~39~~.36	435
6	.37	441
7	.34	451
8	.28	453
C-1	.27	350
2	.36	386
3	.37	403
4	.38	418
5	.36	424
6	.34	438
7	.35	445
8	.31	447
AVERAGE		

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
D-1	.36	360
2	.39	388
3	.39	404
4	.37	418
5	.38	428
6	.33	436
7	.36	443
8	.37	443
E-1	.45	376
2	.42	391
3	.49	417
4	.46	427
5	.43	431
6	.44	434
7	.42	438
8	.32	438
F-1	.44	316
2	.48	379
3	.49	406
4	.49	417
5	.46	425
6	.44	430
7	.43	437
8	.36	438
AVERAGE		

EPA (Dur) 233
4 72

Cyclone Fan OFF

RADIAN
CORPORATION

EPA METHODS 1-4, 5

NOMOGRAPH DATA

PLANT SITE 07 07-MMS-BI

DATE 4-16-85

SAMPLING LOCATION Baghouse INLET

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.83
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	85
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	~~8~~12
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.98
STATIC PRESSURE IN STACK, in. Hg (P_m ±0.073 x STACK GAUGE PRESSURE in in. H_2O)	P_s	−4.9
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	.98
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	≃40
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	≃.37
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	.49
C FACTOR	.92	
CALCULATED NOZZLE DIAMETER, in.	.25	
ACTUAL NOZZLE DIAMETER, in.	.254	
REFERENCE Δp, in. H_2O	.70	

EPA (Dur) 234
4 72

A-13

METER CALIBRATION DATA

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DRY GAS METER CALIBRATION DATA

(English Units) Pretest ☒ Post Test ☐

DGM Y = .9987

Date 3/19/85 Barometric Pressure, Bp = 29.74, 30.06 (3/20/1

Meter Box # 2 Dry Gas Meter # -

Orifice manometer setting, ΔH, in. H_2O	Manometer Pressure Of Wet Test Meter Δ HW	DGM Gas volume ~~wet test~~ meter V_w, ft^3	Gas volume dry gas meter V_d, ft^3	DGM Temperature ~~Wet test~~ Meter t_w, °F	Temperature Dry gas meter Inlet t_{di}, °F	Temperature Dry gas meter Outlet t_{do}, °F	Temperature Dry gas meter Average t_d, °F	Time θ, Min. .00	Y	ΔH@
.5	.3	4.900 9.903	73.574 78.620	76,75 75,74	83 88	76 78		12.48	1.0002	1.73
1,0	.5	10.071 19.006	78.781 87.836	75,74 76,75	88 96	79 82		15.92	1.0026	1.75
2.0	.9	82.984 91,813	51,466 60.374	67,66 67,66	79 89	69 71		11.71	1.0022	1.94
3.0	1,1	19.272 29.556	88.113 98.297	76,74 76,74	98 108	82 83		10.82	1.0001	1.99
								Avg.	1.0013 ✓	1.83 ✓

* 3/18/85 - 29.74

.5, 1, 3 - 3/19/85 - 30.06

$$Y = \frac{V_w \left(P_b - \frac{\Delta H_w}{13.6}\right)\left(t_d + 460\right)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)\left(T_w + 460\right)}$$

$$\Delta H@ = \frac{0.0317\,\Delta H}{P_b\,(t_d + 460)}\left[\frac{(t_w + 460)\,\theta}{V_w}\right]^2$$

$\frac{5.003 \times 30.04 \times 541.3 \times .9987}{5.046 \times 30.09 \times 535} = 1.0002$	$\frac{.0317 \times .5}{30.06 \times 541.3}\left(\frac{535 \times 12.48}{5.003}\right)^2 = 1.73$
$\frac{8.935 \times 30.02 \times 546.3 \times .9987}{9.055 \times 30.13 \times 535} = 1.0026$	$\frac{.0317}{30.06 \times 546.3}\left(\frac{535 \times 15.92}{8.935}\right)^2$ 1.75
$\frac{8.829 \times 29.67 \times 537 \times .9987}{8.908 \times 29.89 \times 526.5} = 1.0022$	$\frac{.0317 \times 2}{29.74 \times 537}\left(\frac{526.5 \times 11.71}{8.829}\right)^2$ 1.94
$\frac{10.067 \times 29.98 \times 552.8 \times .9987}{10.284 \times 30.28 \times 535} = 1.0001$	$\frac{.0317 \times 3}{30.06 \times 552.8}\left(\frac{535 \times 10.82}{10.067}\right)^2$ 1.89

Y = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ±0.01.

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O. Tolerance = ±0.15.

Post test tolerance must be within ± 0.05 and within a range of 0.10

Meter Leak Check Front _____ Back

Calibrating technician __________

Pitot Leak Check _____

Electrical Check _____

Remarks

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DRY GAS METER CALIBRATION DATA

(English Units) Pretest ☐ Post Test ☒

γ of DGM: .9987

Date 5/13/85 **Barometric Pressure, Bp =** 29.75

Meter Box # 2 **Dry Gas Meter #** ______

Orifice manometer setting, ΔH, in. H_2O	Manometer Pressure Of ~~Wet Test~~ Meter ΔM DGM	DGM Gas volume ~~wet~~ test meter V_w, ft^3	Gas volume dry gas meter V_d, ft^3	DGM ~~Wet test~~ Meter t_w, °F	Dry gas meter Inlet t_{di}, °F	Dry gas meter Outlet t_{do}, °F	Dry gas meter Average t_d, °F	Time θ, Min. .00	γ	ΔH@
1.2	.55	11.847 21.599	96.794 106.657	74.74 74.75	77 80	76 78			.9896	1.88
1.2	.55	21.599 31.435	106.657 116.631	75.74 76.75	81 84	78 80			.9912	1.86
1.2	.55	31.435 41.535	116.631 26.915	75.75 75.75	84 87	80 80			.9908	1.89
								ΔH@ Avg.	.9905	1.88

γ

$$\frac{V_w\left(P_b - \frac{\Delta M}{13.6}\right)\left(t_d + 460\right)}{V_d\left(P_b + \frac{\Delta H}{13.6}\right)\left(T_w + 460\right)}$$

ΔH@

$$\frac{0.0317\,\Delta H}{P_b\left(t_d + 460\right)}\left[\frac{\left(t_w + 460\right)\theta}{V_w}\right]^2$$

$\frac{9.752 \times 29.71 \times 537.8 \times .9987}{9.863 \times 29.84 \times 534.3} = .9896$	$\frac{.0317 \times 1.2}{29.75 \times 537.8}\left(\frac{534.3 \times 16.25}{9.752}\right)^2 = 1.88$
$\frac{9.836 \times 29.71 \times 540.8 \times .9987}{9.974 \times 29.84 \times 535} = .9912$	$\frac{.0317 \times 1.2}{29.75 \times 540.8}\left(\frac{535 \times 16.29}{9.836}\right)^2 = 1.86$
$\frac{10.1 \times 29.71 \times 542.8 \times .9987}{10.284 \times 29.84 \times 535} = .9908$	$\frac{.0317 \times 1.2}{29.75 \times 542.8}\left(\frac{535 \times 16.8}{10.1}\right)^2 = 1.89$

γ = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ±0.01.

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O. Tolerance = ±0.15.

Post test tolerance must be within ± 0.05 and within a range of 0.10

Meter Leak Check Front ✓ Back ✓

Pitot Leak Check ______

Electrical Check ✓

Calibrating technician ______

Remarks

DRY GAS METER CALIBRATION DATA

(English Units) Pretest ☒ Post Test ☐

DGM γ = .9987

Date 3/18/85 **Barometric Pressure, Bp =** 29.74

Meter Box # 7 **Dry Gas Meter #** ______

Orifice manometer setting, ΔH, in. H_2O	Manometer Pressure Of Wet Test Meter Δ HW	DGM Gas volume ~~wet test~~ meter V_w, ft^3	Gas volume dry gas meter V_d, ft^3	DGM Temperature ~~Wet test~~ Meter t_w, °F	Dry gas meter Inlet t_{di}, °F	Dry gas meter Outlet t_{do}, °F	Dry gas meter Average t_d, °F	Time θ, Min. .00	γ	ΔH@	
.5	-.3	43.825 48.867	72.143 77.305	65,65 65,65	75 79	68 69			.9879	1.794	[illegible]
1.0	-.5	49.190 54.370	77.632 82.943	65,65 66,65	81 86	69 72			.9921	1.954	9
2.0	.82	54.845 65.452	83.424 94.269	66,65 66,66	88 97	74 75			1.0025	1.992	14
3.0	1.1	65.978 75.976	94.816 105.148	66,66 66,66	98 103	78 79			.9995	1.875	10
								Avg.	.9955	1.85	

γ

$$\frac{V_w\left(P_b - \frac{\Delta H_w}{13.6}\right)\left(t_d + 460\right)}{V_d\left(P_b + \frac{\Delta H}{13.6}\right)\left(T_w + 460\right)}$$

ΔH@

$$\frac{0.0317\ \Delta H}{P_b\left(t_d + 460\right)}\left[\frac{\left(t_w + 460\right)\theta}{V_w}\right]^2$$

$\frac{5.042 \times 29.72 \times 528 \times .9987}{5.162 \times 29.78 \times 525} = .9879$	$\frac{.0317 \times .5}{29.74 \times 532.5}\left(\frac{523 \times 10.86}{5.042}\right)^2 = 1.794$
$\frac{5.18 \times 29.7 \times 537 \times .9987}{5.311 \times 29.81 \times 525.3} = .9921$	$\frac{.0317}{29.74 \times 537}\left(\frac{525.3 \times 9.53}{5.18}\right)^2 = 1.854$
$\frac{10.607 \times 29.68 \times 543.5 \times .9987}{10.845 \times 29.87 \times 525.8} = 1.0025$	$\frac{.0317 \times 2}{29.74 \times 543.5}\left(\frac{525.8 \times 14.01}{10.607}\right)^2 = 1.892$
$\frac{9.998 \times 29.66 \times 549.5 \times .9987}{10.332 \times 29.94 \times 526} = .9995$	$\frac{.0317 \times 3}{29.74 \times 549.5}\left(\frac{526 \times 10.79}{9.998}\right)^2 = 1.875$

γ = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ±0.01.

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O. Tolerance = ±0.15.

Post test tolerance must be within ± 0.05 and within a range of 0.10

Meter Leak Check Front ✓ Back ✓

Pitot Leak Check ✓

Electrical Check ✓

Calibrating technician ______

Remarks

DRY GAS METER CALIBRATION DATA

(English Units) Pretest ☐ Post Test ☑

Date 5-8-85 Barometric Pressure, Bp = 29.90

Meter Box # 7 Dry Gas Meter # ____

Orifice manometer setting, ΔH, in. H_2O	Manometer Pressure Of Wet Test Meter ΔHw	Gas volume wet test meter V_{wj} ft³	Gas volume dry gas meter V_{dj} ft³	Temperature Wet test Meter t_w, °F	 Dry gas meter Inlet t_{di}, °F	 Outlet t_{do}, °F	 Average t_d, °F	Time θ, Min. .00	γ	ΔH@
1.00	.46	313.572 323.971	625.616 636.329	74/77 76/74	80 91	76 79	82	19.16	.9819	1.89
1.00	.46	324.335 334.354	636.698 647.089	76/74 76/75	92 97	80 83	88	18.40	.9841	1.87
1.00	.46	335.349 345.397	648.117 658.588	76/75 77/75	97 97	84 85	91	18.44	.9829	1.86

γ 10.399 10.713
10.019 10.391
10.048 10.471

ΔH@ Avg. .9829 1.87

$$\frac{V_w\left(Pb - \frac{\Delta Hw}{13.6}\right)(td + 460)}{Vd\left(Pb + \frac{\Delta H@}{13.6}\right)(Tw + 460)}$$

$$\frac{0.0317\ \Delta H}{Pb\ (td + 460)}\left[\frac{(Tw + 460)\ \theta}{Vw}\right]^2$$

19:09.82
18:23.99
18:26.40

$\frac{10.399\ (29.9 - .46/13.6)(542)}{10.713\ (29.9 - 1.00/13.6)(534)} = .9817$ ✓	$\frac{.0317(1.00)}{29.9\ (542)}\left[\frac{534 \cdot 19.16}{10.399}\right]^2 = 1.89$
$\frac{10.019\ (29.9 - .46/13.6)(548)}{10.391\ (29.9 - 1.00/13.6)(535)} = .9841$	$\frac{.0317(1.00)}{29.9(548)}\left[\frac{535 \cdot 18.40}{10.019}\right]^2 = 1.87$
$\frac{10.048\ (29.9 - .46/13.6)(551)}{10.471\ (29.9 - 1.00/13.6)(536)} = .9829$	$\frac{.0317(1.00)}{29.9\ (551)}\left[\frac{536 \cdot 18.44}{10.048}\right]^2 = 1.86$

γ = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ±0.01.

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O. Tolerance = ±0.15.

Post test tolerance must be within ± 0.05 and within a range of 0.10

Meter Leak Check Front ____ Back

Pitot Leak Check ____

Electrical Check ____

Remarks

Calibrating technician DG

DRY GAS METER CALIBRATION DATA

(English Units) Pretest ☒ Post Test ☐

Date 3/22/85 Barometric Pressure, Bp = 29.76

Meter Box # #10 Dry Gas Meter # #10

Orifice manometer setting, ΔH, in. H_2O	Manometer Pressure Of Wet Test Meter Δ Hw	Gas volume wet test meter V_w, ft³	Gas volume dry gas meter V_d, ft³	Temperature				Time θ, Min. .00	γ	ΔH@
				Wet test	Dry gas meter					
				Meter t_w, °F	Inlet t_{di}, °F	Outlet t_{do}, °F	Average t_d, °F			
.5	.3	61.649 66.607	71.257 76.340	76,76 77,76	86 91	82 85		11.95	.9898	1.63
1.0	.48	67.045 73.068	76.783 82.935	77,76 77,77	91 95	84 87		10.44	.9968	1.68
2.0	.75	77.007 87.007	86.917 97.037	76,78 76,77	86 97	82 85		12.89	1.0010	1.86
3.0	1.05	87.436 97.439	97.465 107.555	78,76 78,76	97 103	84 88		10.37	1.0094	1.79
								Avg.	.9993 ✓	1.74 ✓

γ

$$\frac{V_w\left(P_b - \frac{\Delta H_w}{13.6}\right)\left(t_d + 460\right)}{V_d\left(P_b + \frac{\Delta H}{13.6}\right)\left(T_w + 460\right)}$$

ΔH@

$$\frac{0.0317\ \Delta H}{P_b\left(t_d + 460\right)}\left[\frac{\left(t_w + 460\right)\theta}{V_w}\right]^2$$

$\frac{4958 \times 29.74 \times 546 \times .9987}{5.083 \times 29.8 \times 536.3} = .9898$	$\frac{.0317 \times .5}{29.76 \times 546}\left(\frac{536.3 \times 11.95}{4.958}\right)^2 = 1.63$
$\frac{6.023 \times 29.72 \times 549.3 \times .9987}{6.152 \times 29.83 \times 536.8} = .9968$	$\frac{.0317}{29.76 \times 549.3}\left(\frac{536.8 \times 10.44}{6.023}\right)^2 = 1.68$
$\frac{10 \times 29.7 \times 547.5 \times .9987}{10.12 \times 29.91 \times 536.8} = 1.0010$	$\frac{.0317 \times 2}{29.76 \times 547.5}\left(\frac{536.8 \times 12.89}{10}\right)^2 = 1.86$
$\frac{10.003 \times 29.68 \times 553 \times .9987}{10.09\ 29.98 \times 537}$ 1.0094	$\frac{.0317 \times 3}{29.76 \times 553}\left(\frac{537 \times 10.37}{10.003}\right)^2 = 1.79$

γ = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ±0.01.

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O. Tolerance = ±0.15.

Post test tolerance must be within ± 0.05 and within a range of 0.10

Meter Leak Check Front ✓ Back ✓

Calibrating technician flg

Pitot Leak Check ✓

Electrical Check ✓

Remarks

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DRY GAS METER CALIBRATION DATA

(English Units) Pretest ☐ Post Test ☒

Y of DGM = .9987

Date 5/9/85 **Barometric Pressure, Bp =** 30.00

Meter Box # 10 **Dry Gas Meter #** ____

Orifice manometer setting, ΔH, in. H_2O	DGM Manometer Pressure Of ~~Wet Test~~ Meter ΔHw	DGM Gas volume ~~wet test~~ meter V_w, ft^3	Gas volume dry gas meter V_d, ft^3	DGM Temperature ~~Wet test meter~~ Meter t_w, °F	Temperature Dry gas meter Inlet t_{di}, °F	Temperature Dry gas meter Outlet t_{do}, °F	Temperature Dry gas meter Average t_d, °F	Time θ, Min. .00	Y	ΔH@	Vacu "H
.85	.45	83.079 89.529	48.572 55.187	76,75 76,76	85 90	76 77			.9861		3
,85	.45	89.529 98,127	55,187 64.020	76,75 76,76	89 95	78 81			.9873		3
,85	.45	98,127 106.015	64,020 72131	77,76 77,77	94 97	82 84			.9909		3
							ΔH@	Avg.	.9881 ✓		

Y

$$\frac{V_w \left(P_b - \frac{\Delta H_w}{13.6}\right)\left(t_d + 460\right)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)\left(T_w + 460\right)}$$

ΔH@

$$\frac{0.0317\, \Delta H}{P_b \left(t_d + 460\right)}\left[\frac{\left(t_w + 460\right)\theta}{V_w}\right]^2$$

$\frac{6.45 \times 29.97 \times 542 \times .9987}{6.615 \times 30.06 \times 535.8} = .9861$	
$\frac{8.598 \times 29.97 \times 545.8 \times .9987}{8.833 \times 30.06 \times 535.8} = .9873$	
$\frac{7.888 \times 29.97 \times 549.3 \times .9987}{8.111 \times 30.06 \times 536.8} = .9909$	

Y = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ±0.01.

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O. Tolerance = ±0.15.

Post test tolerance must be within ± 0.05 and within a range of 0.10

Meter Leak Check Front ✓ Back ✓

Calibrating technician flg

Pitot Leak Check ____

Electrical Check ✓

Remarks

APPENDIX B

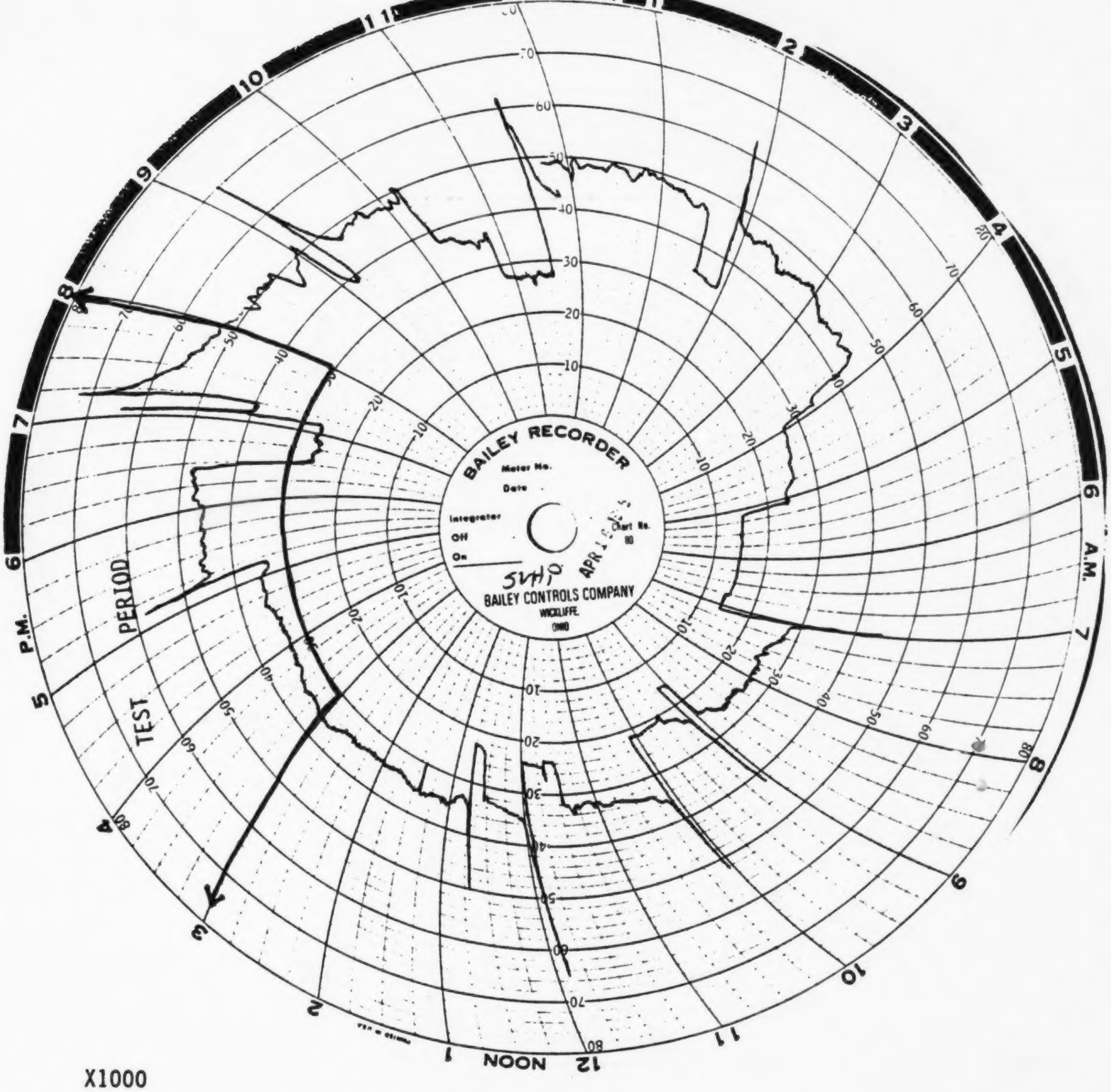
PROCESS MONITORING DATA

TABLE B-1. BOILER OPERATING DATA

Run (Date)	Time	Steam Flow lb/hr	Steam Header Press psi	Steam Line Press psi	Steam Temp °F	Feed-Water Temp °F	Boiler Outlet Flue Gas Temp °F	Air Heater Exit Temp °F	ID Fan Amps	Furnace Pressure (inches H_2O)								Veneer Plant HP Steam lb/hr	Veneer Plant LP Steam lb/hr	#4 Mill Low P Steam lb/hr	Dry Kiln lb/hr	Atlas Bin Slide Gate Position
										Air Heater Outlet	Boiler Outlet	Combustion Chamber	Ash Pit #3	Ash Pit #2	Ash Pit #1	Over Fire	Oil Burner					
Run 1 (4/16/85)	1500	42000	310	270	---	420	640	550	120	-2	-1.8	-0.03	1.04	1.00	0.86	0.1	0	35000	---	---	---	---
	1600	41000	310	270	---	430	640	550	115	-1.9	-1.8	-0.03	1.00	0.98	0.80	0.1	0	34000	---	---	---	---
	1700	42000	308	270	---	425	660	550	115	-1.9	-1.8	-0.03	1.50	1.50	1.20	0.1	0	33000	---	---	---	---
	1800	47000	320	270	---	420	670	560	110	-1.7	-1.6	-0.03	1.40	1.38	1.08	0.1	0	46000	---	---	---	---
	1900	42000	340	270	---	430	660	560	105	-1.7	-1.6	-0.03	1.50	1.48	1.20	0.01	0	27000	---	---	---	---
	2000	47000	320	270	---	410	670	560	115	-2.0	-1.9	-0.03	2.0	2.0	1.60	0.01	0	52000	---	---	---	---
Run Average		43500	318	270	---	423	657	555	113	-1.9	-1.8	-0.03	1.41	1.4	1.12	0.07	0	38000	---	---	---	---
Run 2 (4/17/85)	1030	49000	310	265	545	425	680	580	120	-2.0	-1.9	-0.04	0.78	0.80	0.68	0.1	0	48000	37000	44000	50000	---
	1130	50000	320	270	550	420	690	585	110	-1.9	-1.8	-0.02	1.18	1.2	0.95	0.1	0	38000	36000	38000	58000	58
	1230	56000	320	265	545	425	690	590	105	-1.8	-1.7	-0.02	0.90	0.90	0.74	0.1	0	38000	34000	38000	40000	53
	1330	50000	320	270	545	425	690	590	105	-1.8	-1.7	-0.02	0.82	0.82	0.70	0.1	0	40000	30000	42000	42000	50
	1430	42000	315	265	545	430	690	580	105	-1.7	-1.6	-0.01	0.90	0.96	0.74	0.1	0	38000	38000	48000	40000	89
Run Average		49400	317	267	546	425	688	585	109	-1.8	-1.7	-0.02	0.92	0.94	0.76	0.1	0	40400	35000	42000	46000	63
Run 3 (4/18/85)	0945	42000	305	260	540	445	640	550	105	-1.9	-1.8	-0.03	.64	.55	.44	0.01	0	42000	28000	43000	58000	57
	1045	42000	310	265	545	435	650	560	105	-1.9	-1.8	-0.04	.64	.63	.56	0.01	0	34000	32000	47000	23000	54
	1145	45000	310	265	545	420	660	570	100	-1.8	-1.7	-0.02	.66	.65	.56	0.01	0	56000	18000	39000	28000	87
	1245	52000	310	260	540	410	670	580	105	-1.9	-1.8	-0.02	.74	.72	.62	0.01	0	55000	15000	40000	12000	63
	1345	51000	330	265	540	420	680	580	95	-1.7	-1.6	-0.01	.92	.94	.77	0.01	0	55000	14000	40000	22000	78
	1445	53000	325	265	540	415	680	585	90	-1.7	-1.6	-0.01	.90	.90	.72	0.01	0	55000	15000	44000	18000	63
Run Average		47500	378	263	542	424	663	571	100	-1.8	-1.7	-0.02	0.75	0.73	0.61	0.01	0	49500	20000	42000	27000	67

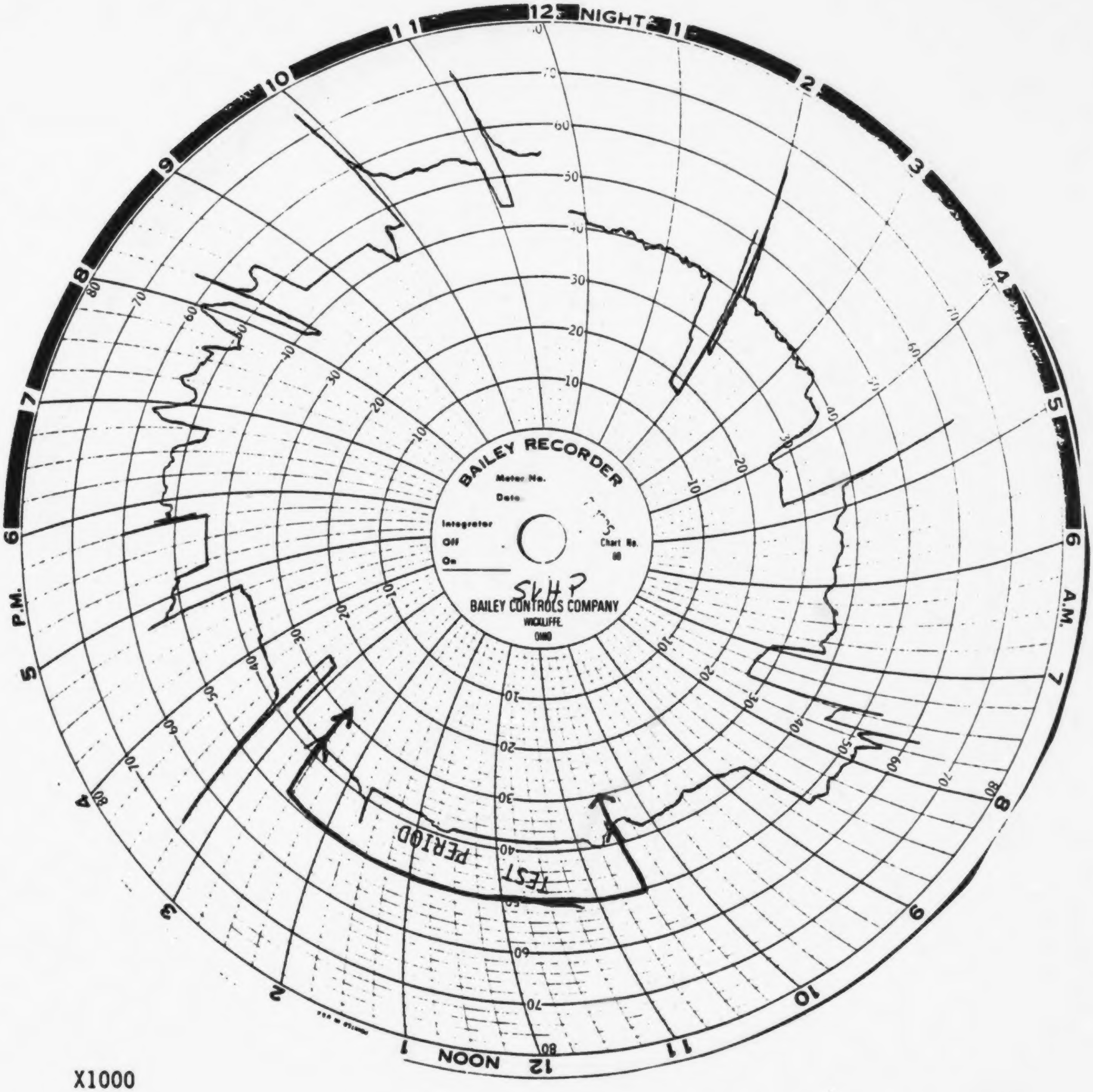
TABLE B-2. BAGHOUSE OPERATING DATA

Run	Date	Time	P Inches H_2O	Temp °F	Comments
1	4/16/85	1500	13	470	
		1600	14	470	
		1700	13.5	460	
		1800	12.7	475	
		1900	12.5	470	
	Run Average		13.1	469	
2	4/17/85	1030	14.5	500	High temp alarm tripped.
		1130	13.5	500	
		1230	14.0	500	
		1330	14.0	500	
		1430	14.0	490	
	Run Average		14.0	500	
3	4/18/84	945	12.5	470	
		1045	12.5	480	
		1145	13.5	480	
		1245	14.0	490	
		1345	14.0	480	
		1445	14.5	490	
	Run Average		13.5	482	



X1000

Figure B-1. High Pressure Steam Flowrate to Veneer Plant - Run 1.



X1000

Figure B-2. High Pressure Steam Flowrate to Veneer Plant - Run 2.

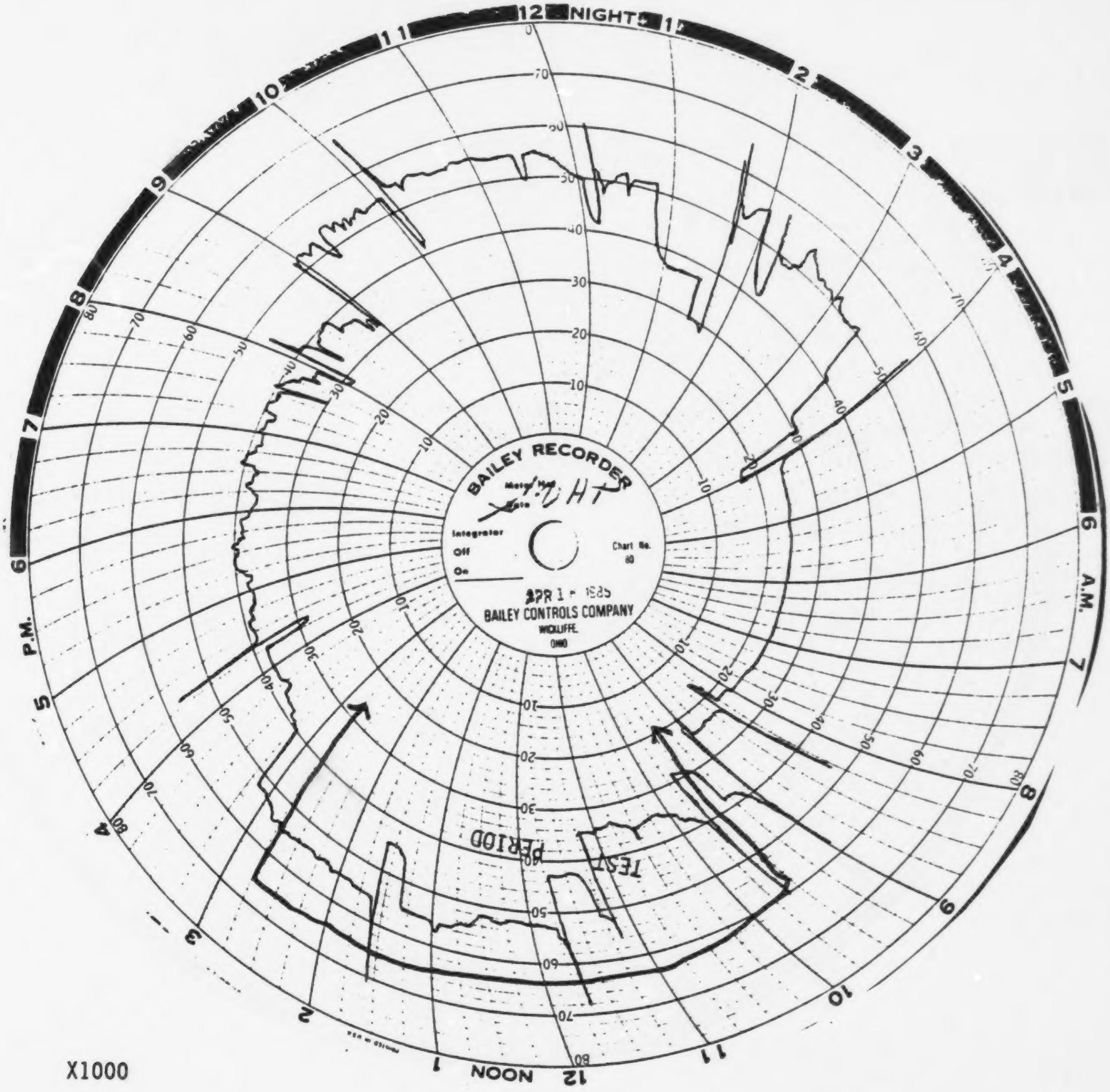
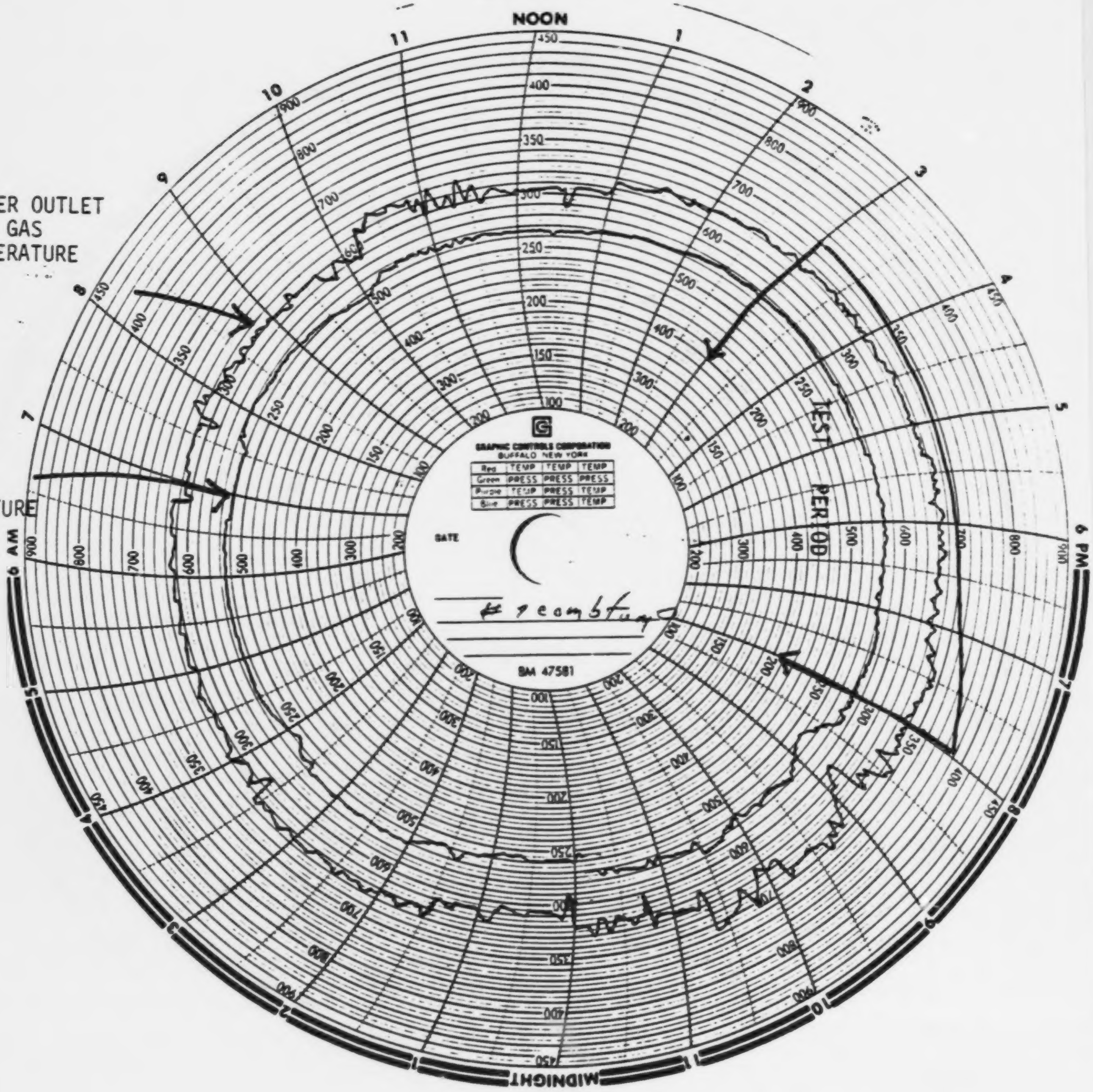


Figure B-3. High Pressure Steam Flowrate to Veneer Plant - Run 3.



BOILER OUTLET FLUE GAS TEMPERATURE

AIR HEATER OUTLET TEMPERATURE

TEST PERIOD

Figure B-4. Boiler Outlet Flue Gas Temperature and Air Heater Outlet Temperature - Run 1.

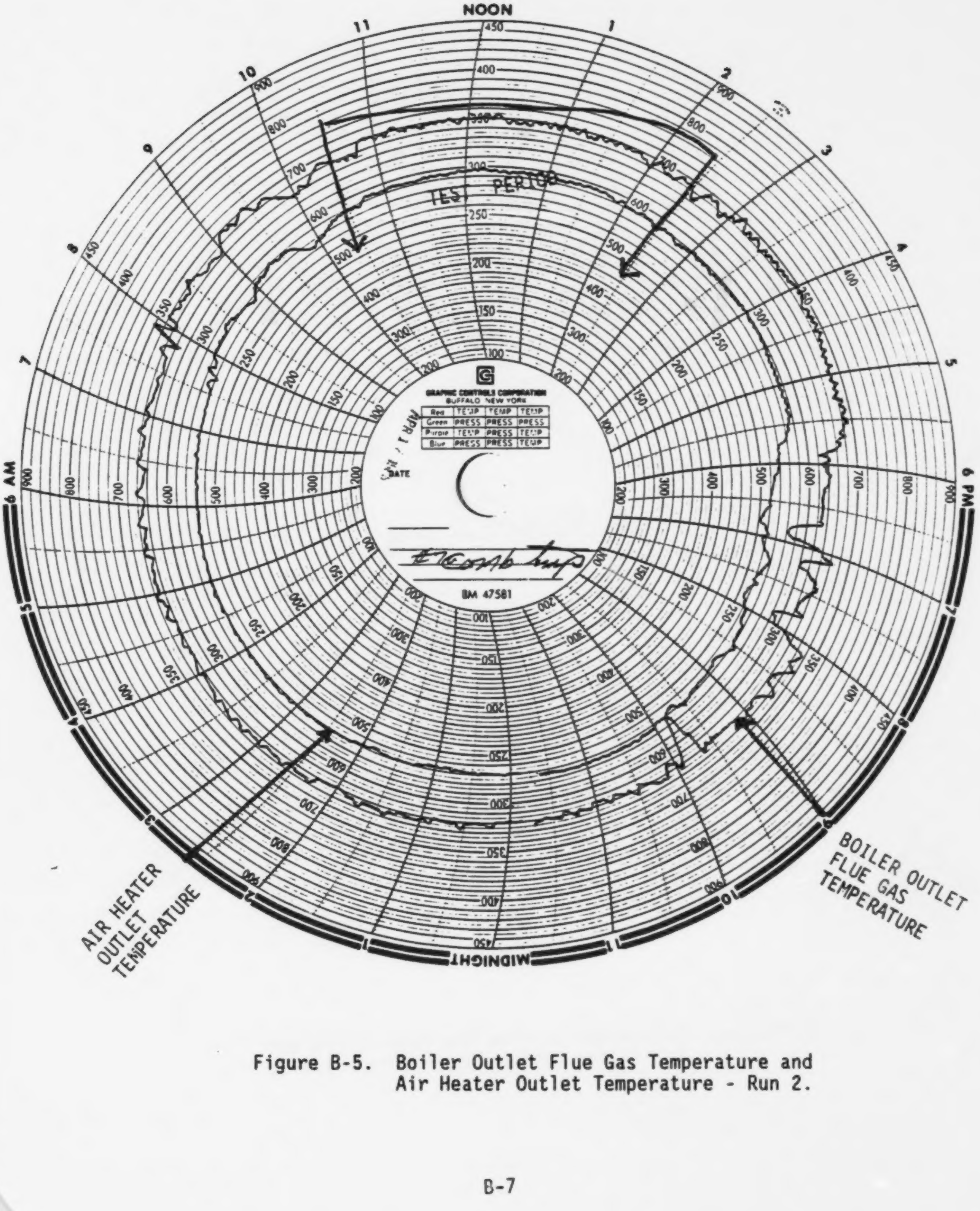


Figure B-5. Boiler Outlet Flue Gas Temperature and Air Heater Outlet Temperature - Run 2.

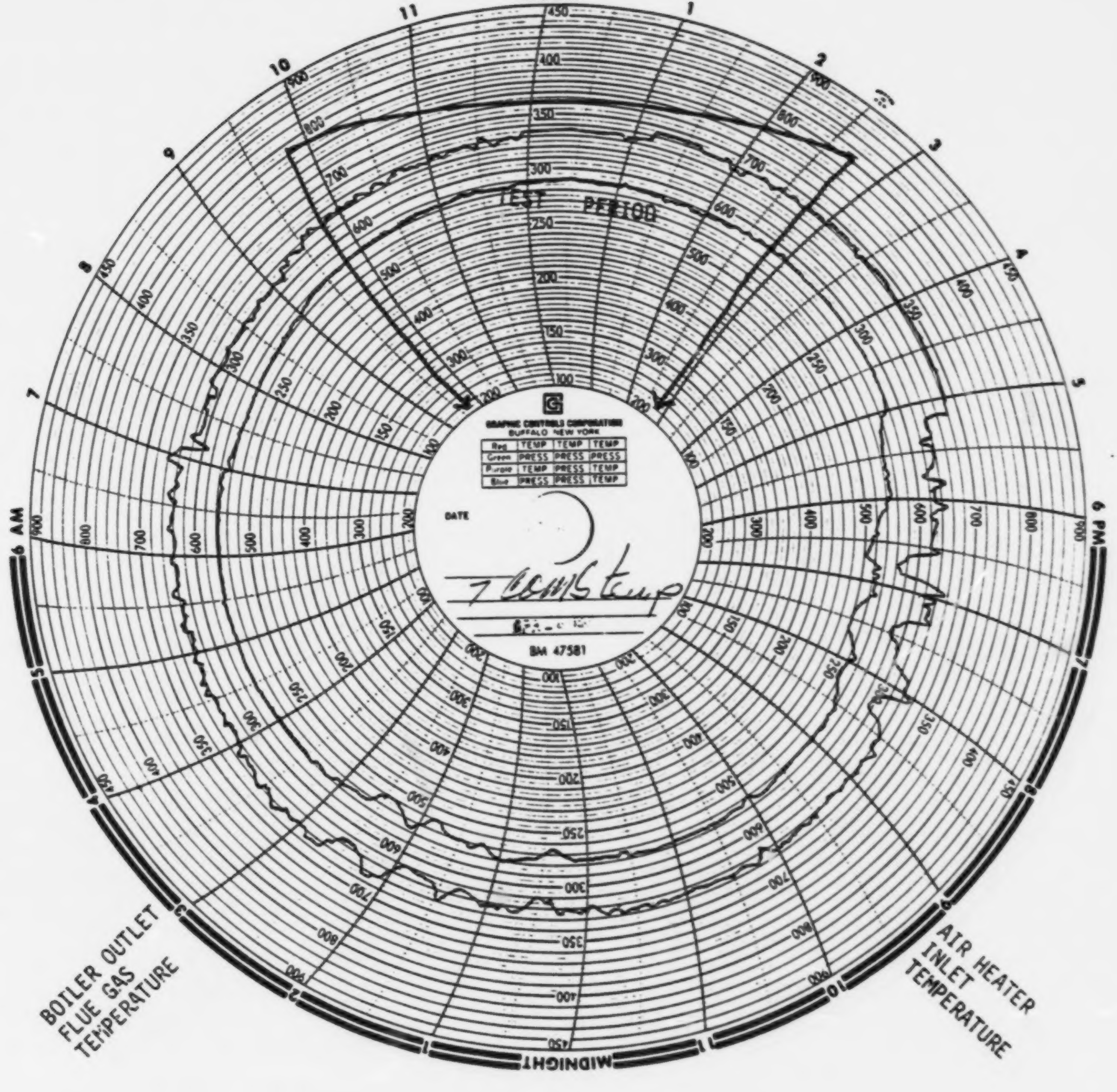


Figure B-6. Boiler Outlet Flue Gas Temperature and Air Heater Outlet Temperature - Run 3.

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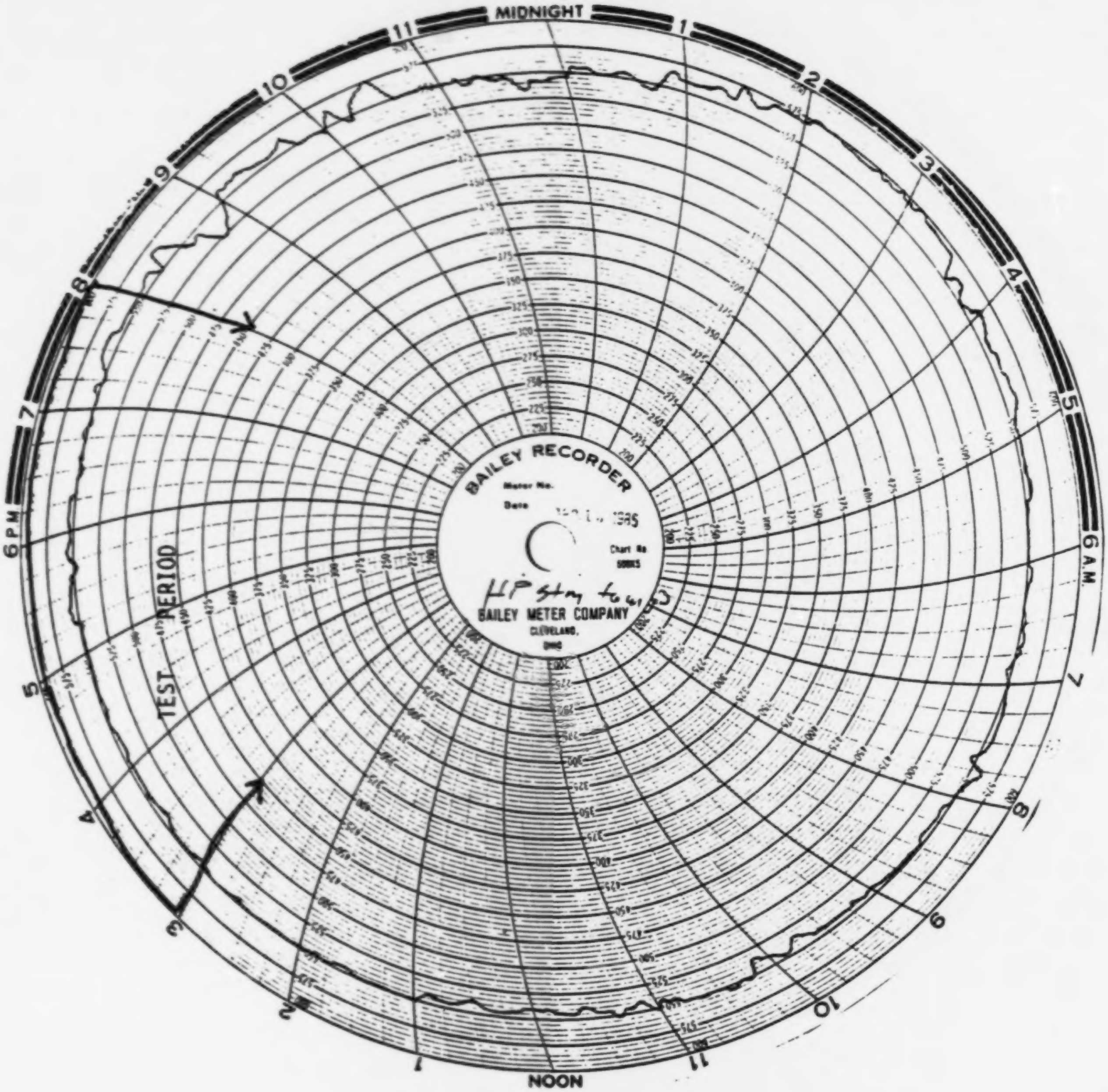

Figure B-7. Boiler WFB-A High Pressure Steam Temperature - Run 1.

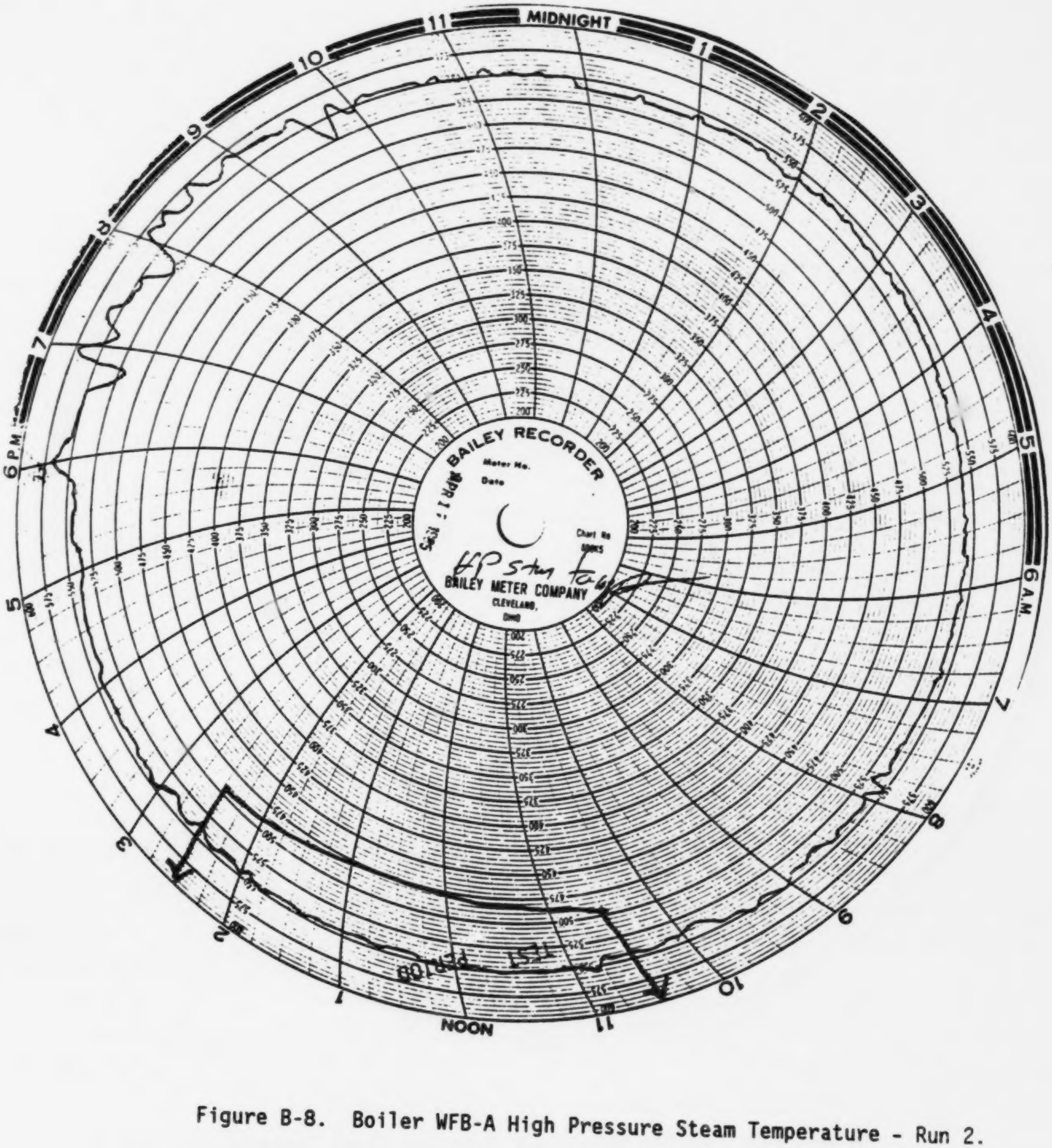

Figure B-8. Boiler WFB-A High Pressure Steam Temperature - Run 2.

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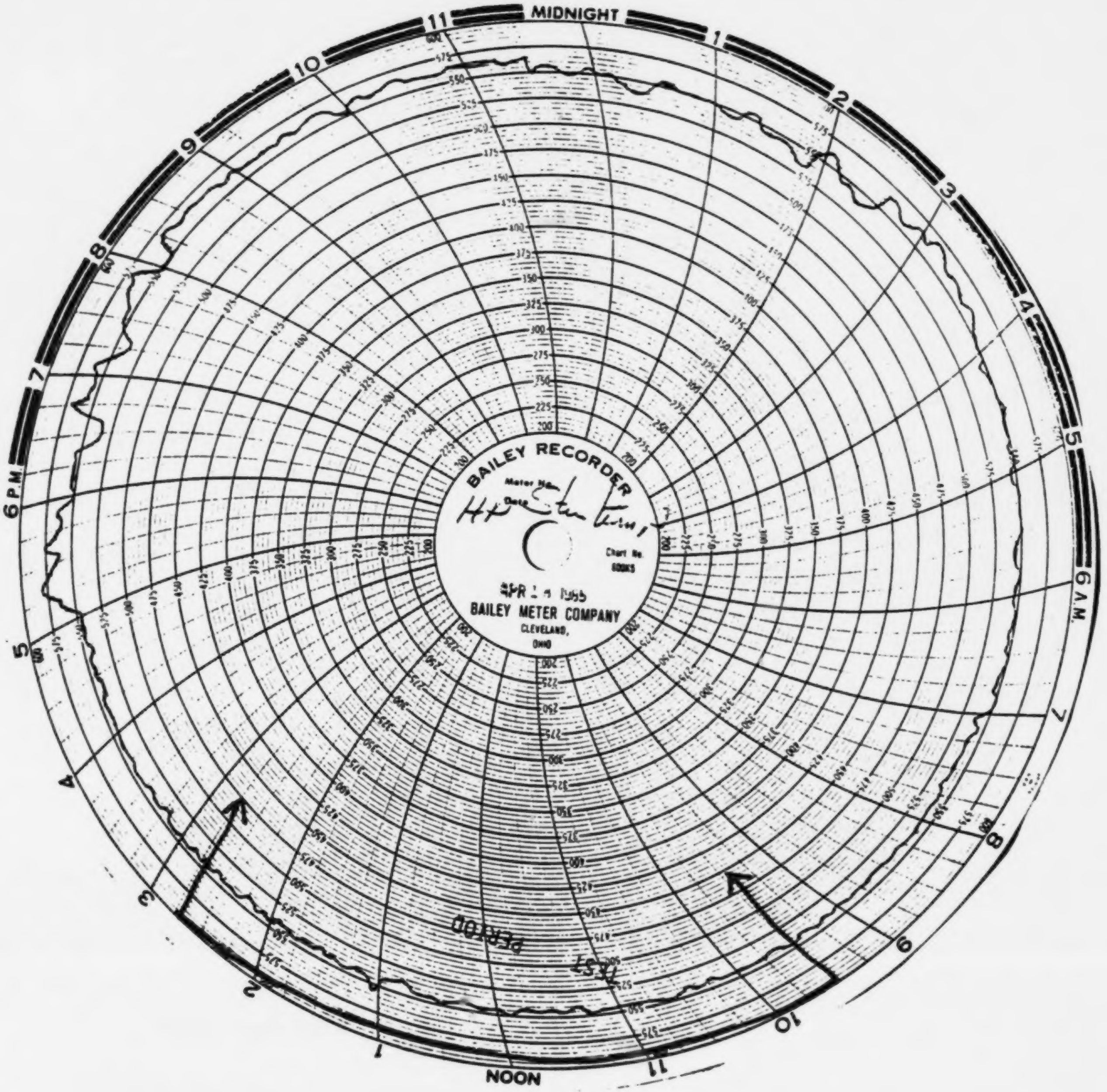
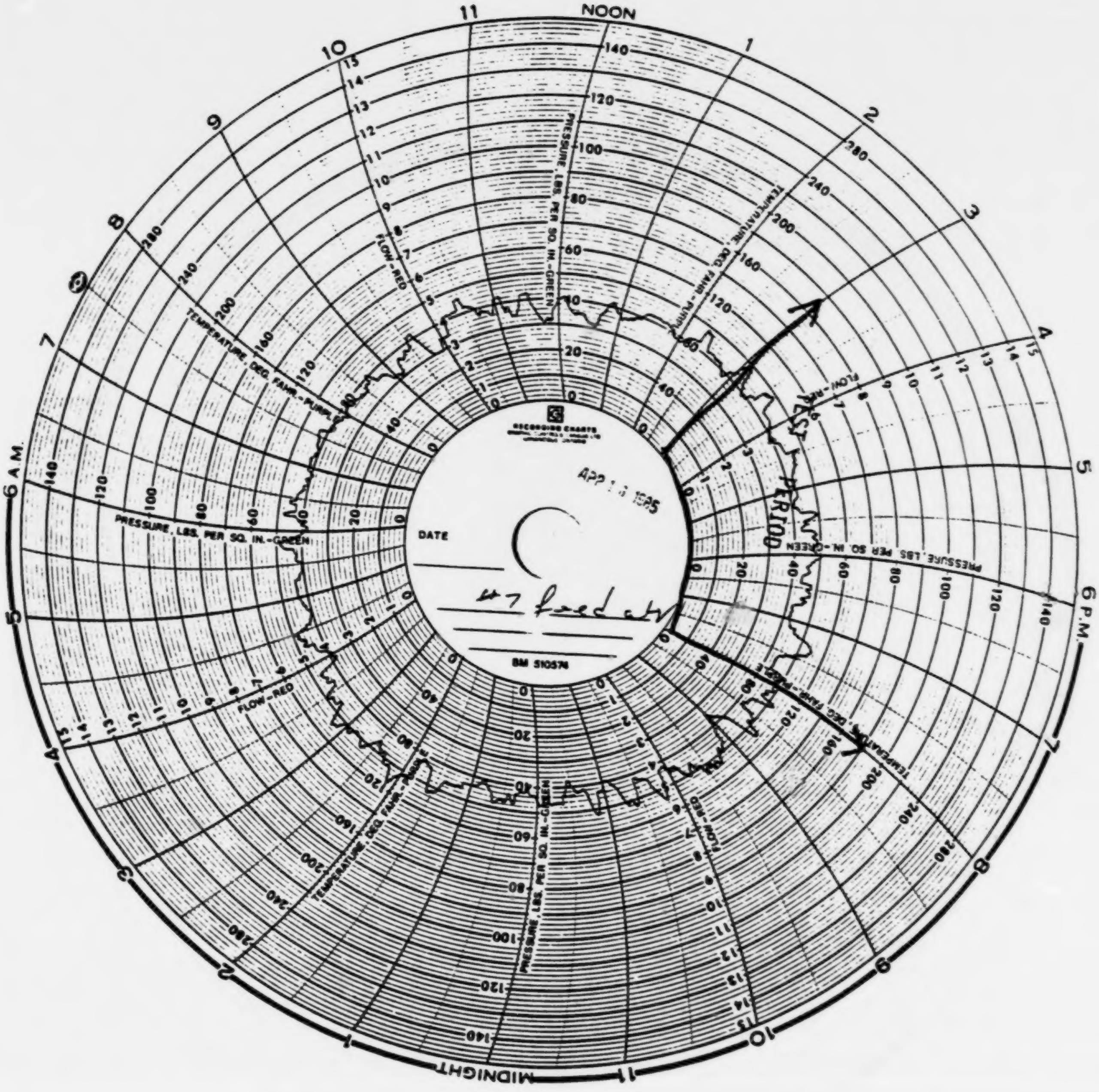


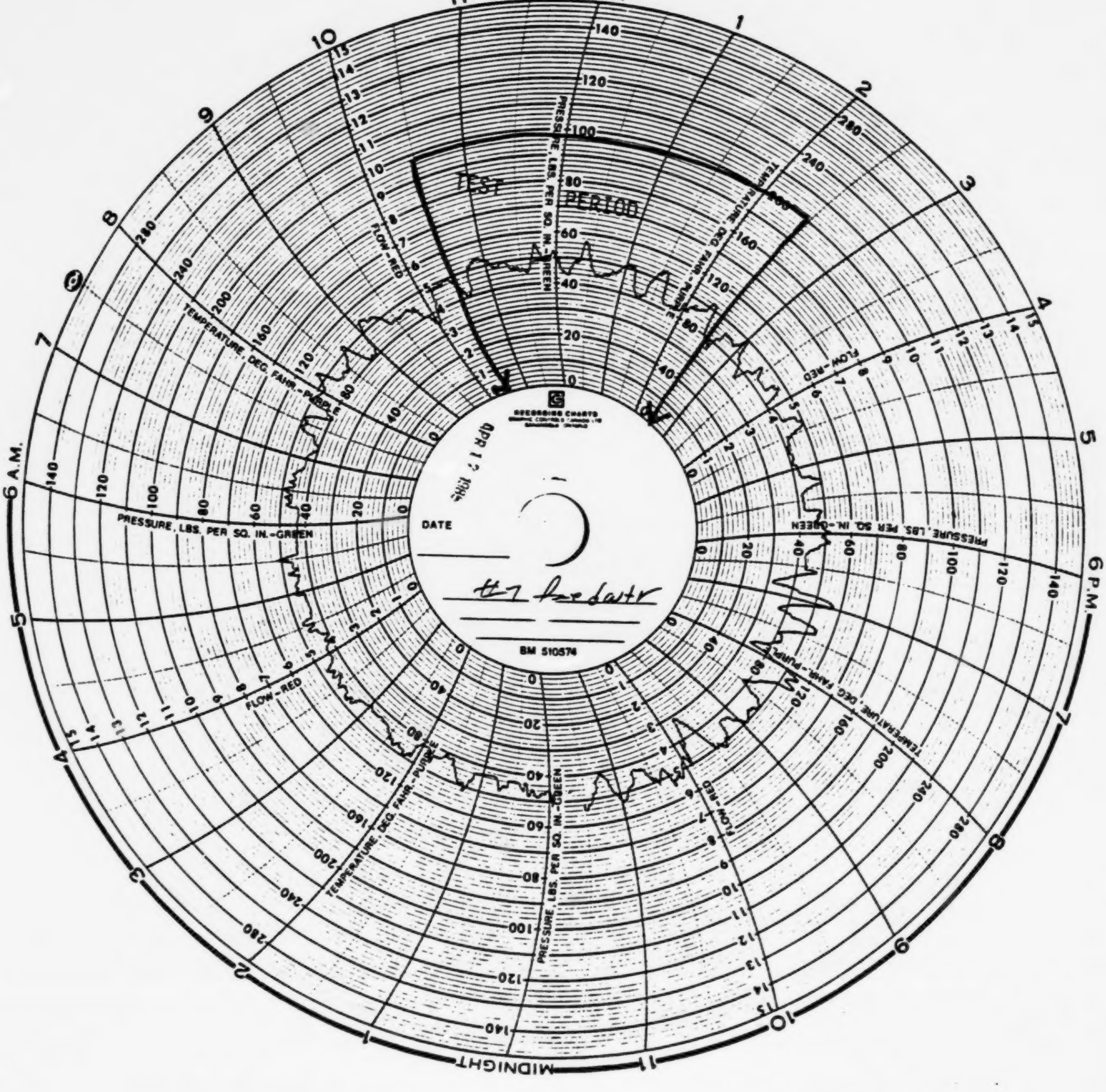
Figure B-9. Boiler WFB-A High Pressure Steam Temperature - Run 3.



Scale indicates feed water use X1000

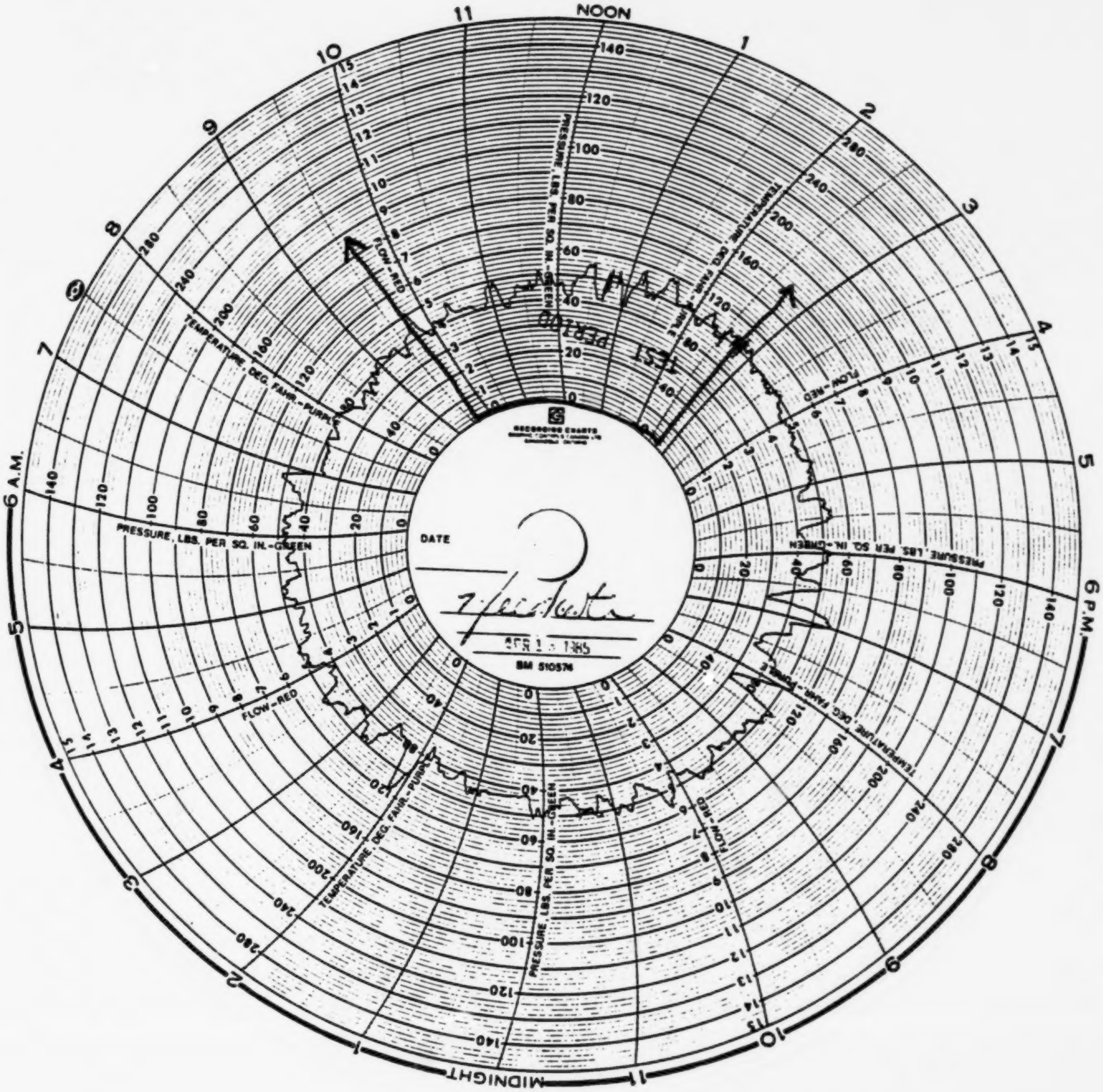
Total flow during run = 1,080,000 gallons

Figure B-10. Feedwater Flowrate - Run 1.



1,126,500 gallons

Figure B-11. Feedwater Flowrate - Run 2.



1,138,500 gallons

Figure B-12. Feedwater Flowrate - Run 3.

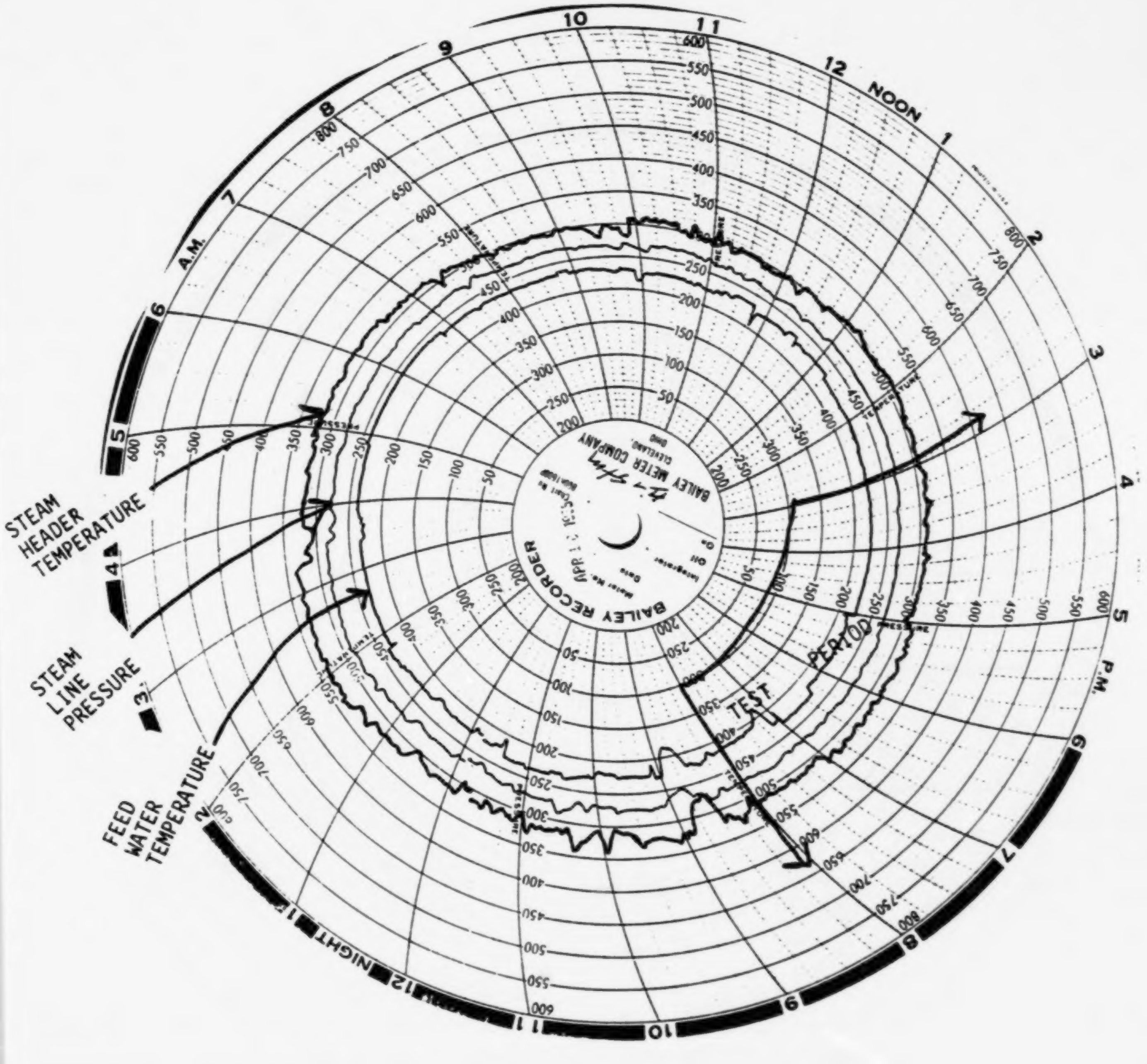


Figure B-13. Boiler WFB-A Feedwater Temperature, Steam Line Pressure, and Steam header pressure - Run 1.

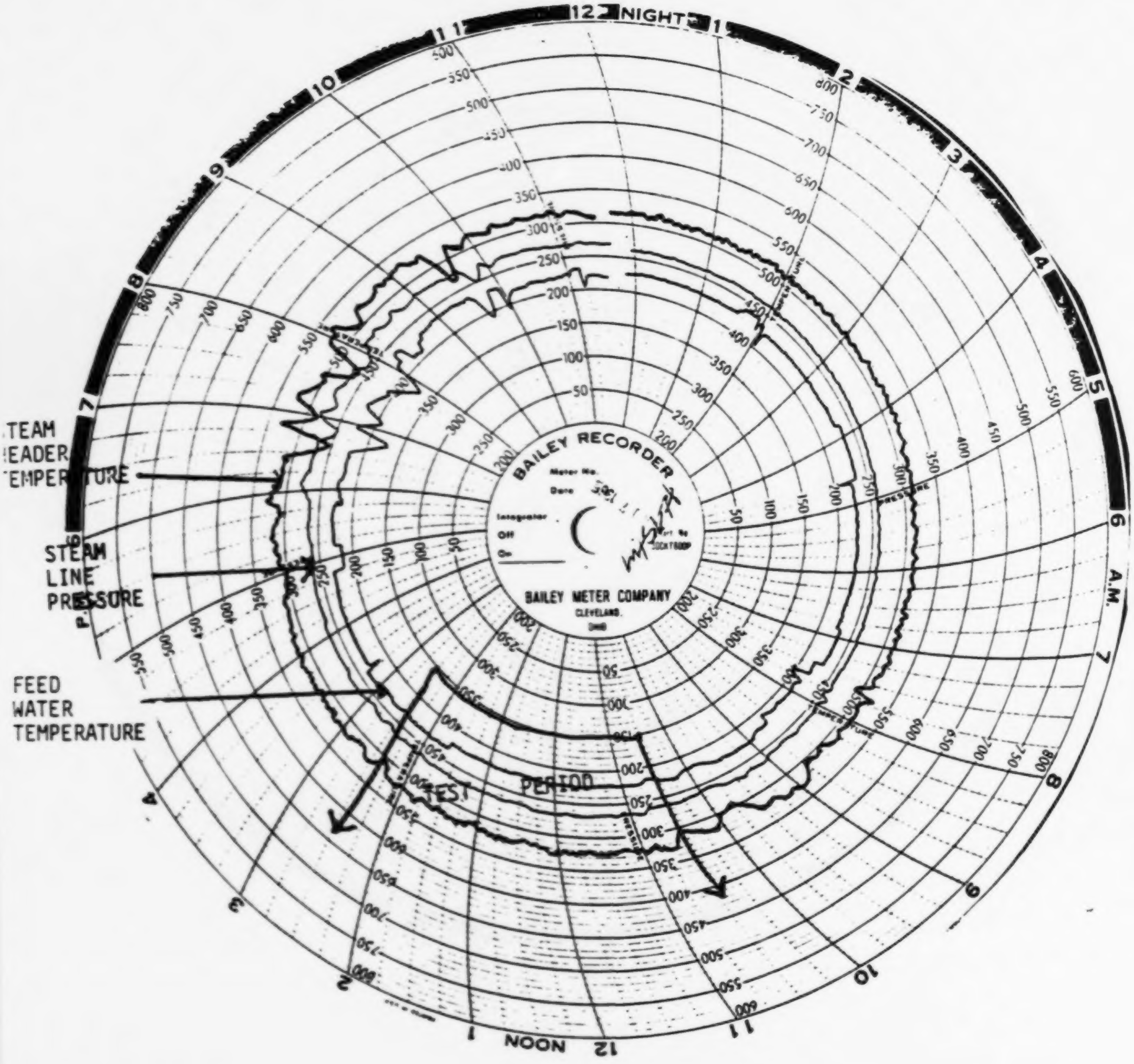
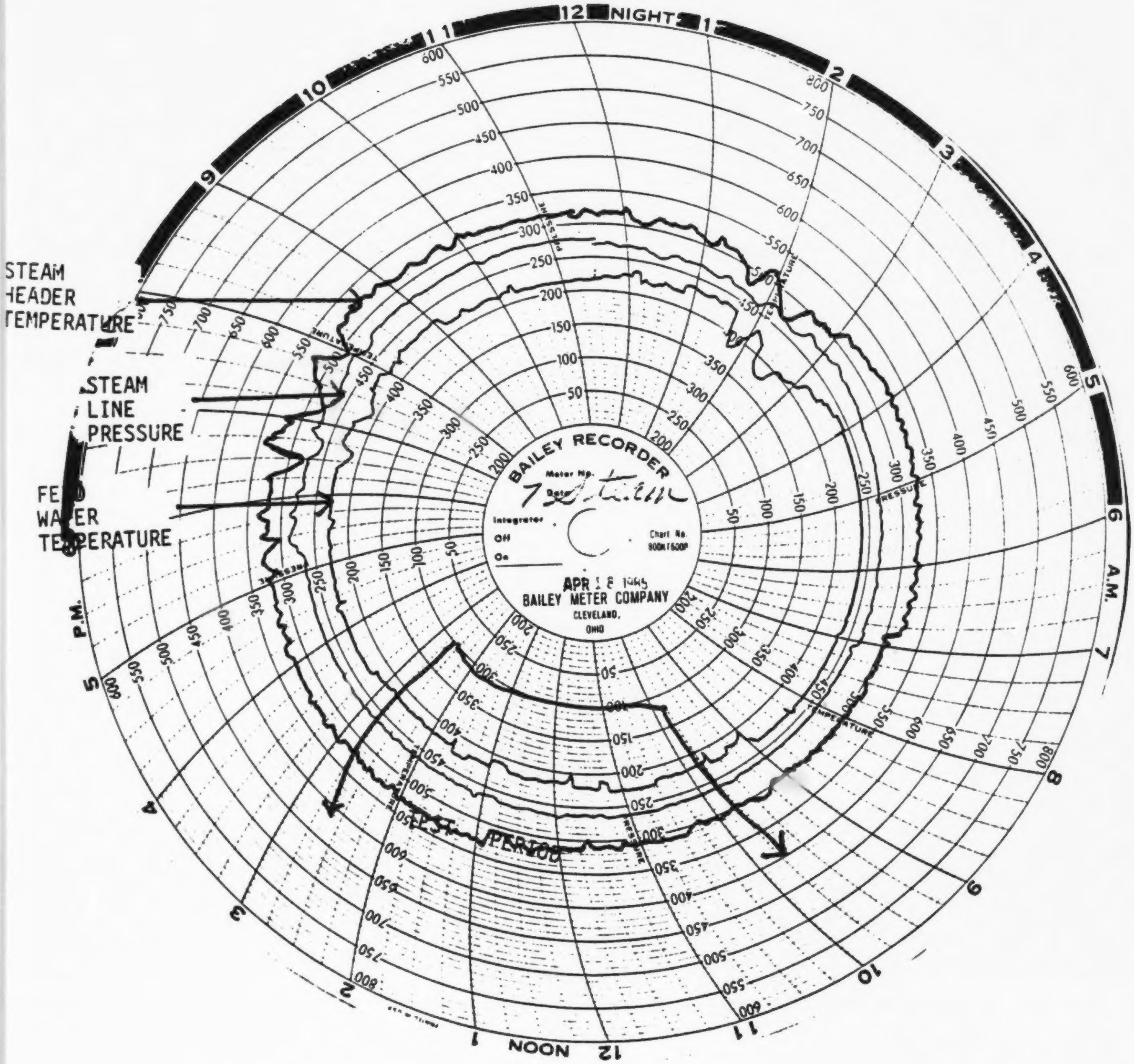


Figure B-14. Boiler WFB-A Feedwater Temperature, Steam Line Pressure, and Steam header pressure - Run 2.



Steam pressure drum
Steam pressure line
Feed water temperature

Figure B-15. Boiler WFB-A Feedwater Temperature, Steam Line Pressure, and Steam header pressure - Run 3.

APPENDIX C

SYSTEMS AUDIT CHECKLISTS

TABLE C-1. CONTINUOUS MONITOR QC CHECKLIST

Date 4/16/85 Site 07 Analyst Dayton/Soria

1. If today is the first calibration day, were multipoint calibrations run for the following parameters?

CO$_2$? Yes X No ____
CO ? Yes X No ____
O$_2$? Yes ✓ No ____
NO$_x$? Yes ✓ No ____
SO$_2$? Yes N/A No ____
THC ? Yes X No ____

Were the correlations coefficients ≥ 0.9950?

CO$_2$? Yes ____ No ____
CO ? Yes ____ No ____
O$_2$? Yes ____ No ____
NO$_x$? Yes ____ No ____
SO$_2$? Yes ____ No ____
THC ? Yes ____ No ____

coefficients not calculated in field.

2. If today is not the first calibration day, were single point RF checks and analytical zeros run for the following?

CO$_2$? Yes X No ____
CO ? Yes X No ____
O$_2$? Yes X No ____
NO$_x$? Yes X No ____
SO$_2$? Yes X No ____
THC ? Yes X No ____

TABLE C-1. CONTINUOUS MONITOR QC CHECKLIST (CONTINUED)

Were the zero values less ≤1% of span?

CO_2 ? Yes X No ____

CO ? Yes X No ____

O_2 ? Yes X No ____

NO_x ? Yes X No ____

SO_2 ? Yes N/A No ____

THC ? Yes X No ____

Were the single point response factors within 20% of the previous multipoint RF?

N/A today

CO_2 ? Yes ____ No ____

CO ? Yes ____ No ____

O_2 ? Yes ____ No ____

NO_x ? Yes ____ No ____

SO_2 ? Yes ____ No ____

THC ? Yes ____ No ____

3. Were the quality control standards run today?

CO_2 ? Yes X No ____

CO ? Yes X No ____

O_2 ? Yes X No ____

NO_x ? Yes X No ____

SO_2 ? Yes N/A No ____

THC ? Yes X No ____

TABLE C-1. CONTINUOUS MONITOR QC CHECKLIST (CONTINUED)

Were the measured QC standard values within 10% of the running mean measurements?

CO_2 ? Yes X No ____
CO ? Yes X No ____
O_2 ? Yes X No ____
NO_x ? Yes X No ____
THC ? Yes X No ____

4. Have all calibrations been recorded in the logbook or on data sheets?

Yes X No ____

5. Was the post-sampling drift check done today?

CO_2 ? Yes X No ____
CO ? Yes X No ____
O_2 ? Yes X No ____
NO_x ? Yes X No ____
SO_2 ? Yes N/A No ____
THC ? Yes X No ____

Did the pretest and post-test response factors agree within ± 10%?

CO_2 ? Yes ____ No ____
CO ? Yes ____ No ____
O_2 ? Yes ____ No ____
NO_x ? Yes ____ No ____
SO_2 ? Yes ____ No ____
THC ? Yes ____ No ____

N/A at this time

WEK
4/16/85

Table C-2. METHOD 2 - DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

SYSTEMS AUDIT CHECKLIST

Site: #07
Date: 4/16/85
Contract:
Auditor: WEK

Yes	No	Comments	Operation
			PRESAMPLING PREPARATIONS
✓			1. Knowledge of process conditions.
✓			2. Calibration of pertinent equipment prior to each field test (e.g., thermocouple).
✓			3. Pitot tube meets geometry requirements.
✓		Inlet less than 2 dia down from disturbance. Doubled # points	4. Sampling location/number of traverse points meet Method 1 specifications.
	X	no reason to suspect	5. Cyclonic flow check performed.
✓			6. Manometer carefully leveled and zeroed.
✓			7. Spare parts and support equipment available.
✓			8. Manometer of appropriate sensitivity.
			SAMPLING OPERATIONS
✓			1. Leak check performed before traverse.
✓			2. Sampling port adequately plugged.
✓			3. Process at correct operating level.
✓			4. Pitot tube properly aligned along its roll and pitch axes throughout the traverse.
✓			5. Pitot tube frequently cleared when measuring in a dust-laden gas.

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Table C-2.
Method 2 Systems Audit Checklist (Continued)

Yes	No	Comments	Operation
			SAMPLING OPERATIONS (Continued)
✓			6. Sufficient time allowed at each traverse point for system to stablize.
✓			7. All pertinent information recorded during sampling.
✓			8. Static pressure properly measured and recorded.
✓			9. Barometric pressure properly measured and recorded.
✓			10. Reliable value for gas molecular weight available (or measured).
✓			11. Final leak check performed.
			POSTSAMPLING OPERATIONS
✓			1. Any unusual conditions recorded.
✓			2. Data sheets dated and initialed.
✓			3. Adequate system for data filing/storage.
✓			4. Data sheets reviewed for completeness.
✓			5. Adequate data reduction/validation procedures.

COMMENTS: ______

RADIAN
CORPORATION

Table C-3. METHOD 3 - GAS ANALYSIS FOR CARBON DIOXIDE OXYGEN AND DRY MOLECULAR WEIGHT

SYSTEMS AUDIT CHECKLIST

Site: 07

Date: 4/16/85

Contract: ______

Auditor: u.EK

Yes	No	Comments	Operation
			PRESAMPLING PREPARATIONS
X			1. Theoretical values (approximate) available.
X			2. Sampling train properly assembled.
X			3. Adequate spare parts and support equipment.
X			4. TCD calibrated and operating normally.
			SAMPLING OPERATIONS
X			1. Initial leak check performed.
X			2. Sampling train purged with stack gas prior to sampling.
X			3. Constant sampling rate maintained.
			POSTSAMPLING OPERATIONS
X			1. Sample properly transferred from bag to GC/TCD, with no exposure to ambient air.
X			2. Replicate analysis performed at appropriate frequency.
X			3. Calibration performed prior to and after each analysis period.
X			4. All data properly recorded using acceptable format.

(Continued)

Table C-3
Method 3 Systems Audit Checklist (Continued)

Yes	No	Comments	Operation
			POSTSAMPLING OPERATIONS (Continued)
	X	all available except sampler/analyst ID on 1st bag. Corrective action initiated	5. Data records indicate date/time of sample collection, date of sample analysis, and initials of both sampler and analyst.
X			6. Adequate data filing/storage procedures.
X			7. Adequate data reduction/validation procedures.

COMMENTS:

Table C-4. METHOD 4 MOISTURE DETERMINATION CHECKLIST TO BE USED BY AUDITORS

Site: 07 Date: 4/16/85

Contract: ____ Auditor: WEK

Yes	No	Comments	Operation
			PRESAMPLING PREPARATIONS
✓			1. Knowledge of process conditions.
✓			2. Calibration of pertinent equipment prior to each field test; in particular, the dry gas meter should be checked before each test.
			ON-SITE MEASUREMENTS
✓			3. Leak testing of sample train after sample run.
✓			4. Addition of water and silica gel to impingers, and correct location of impingers.
✓			5. Constant sampling rate and not exceeding specified rate.
✓			6. Measurement of condensed water to within specified limits.
✓			6. Measurement of condensed water to within specified limits.
✓			7. Record of pertinent process condition during sample collection.
✓			8. Probe maintained at given temperature.
			POSTSAMPLING
✓			9. Calculation procedure/check.
✓			10. Calibration checks.

Table C-4.
Method 4 Moisture Determination Checklist (Continued)

COMMENTS:

Table C-5. MODIFIED METHOD 5 SAMPLING CHECKLIST

Contract: __________ Date: 4/16/85

Site: 07 Auditor: WEK

Yes	No	Comments	Operation
			Preparation of Sampling Train
✓			1. All train openings sealed prior to assembly.
✓			2. Grease-free connections on sampling train
✓			3. Impingers weighed after charging and weights recorded.
✓			4. Proper configuration of components checked after train assembly.
✓			5. Impingers adequately immersed in ice bath.
✓			6. Filter properly handled and sealed in appropriate type holder.
			Preparation of Probe
✓			7. Probe openings sealed prior to train assembly.
✓			8. Probe rinsed with hexane/acetone prior to train assembly.
✓			9. Probe marked for proper sampling distance.
✓			10. Temperature sensor checked. (Calibration available).
✓			11. Nozzle sized correctly, measured with calipers and recorded.

(Continued)

Table C-5. MODIFIED METHOD 5 SAMPLING CHECKLIST
(Continued)

Yes	No	Comments	Operation
			Performance of Leak Check
✓			12. Probe leak checked prior to insertion into the stack and recorded.
✓			13. Leak check performed using workplan protocol.
✓			14. Initial leak check.
✓			15. Final leak check.
			Performance of Test
✓			16. Appropriate sampling time and recording interval selected. (Every 5 minutes)
✓			17. Sampling rate within 10% of the selected rate.
✓			18. Pertinent sampling data recored on field data sheets (DGM readings--initial and final temperature, pilot, etc.)
✓			19. Probe properly positioned. Pitot alignment checked.
	✓	temperature of filter holder rack.	20. Probe temperature monitored during run.
✓			21. Ice bath checked during run.
✓			22. Level and zero of the manometer periodically checked.
✓			23. XAD-2 temperature less than 20°C (68°F).
		N/A	24. Blank train for test run series.

(Continued)

Table C-5. MODIFIED METHOD 5 SAMPLING CHECKLIST
(Continued)

Yes	No	Comments	Operation
			Recovery of Samples
✓		liner not removed.	25. Tip of probe wiped free of particulates. Liner removed from sheath prior to solvent rinsing.
✓			26. New, clean brush used for each sampling run. Was brushing tecnique adequate to minimize sample contamination.
✓			27. Probe ends sealed with clean aluminum foil.
✓			28. Train inlet capped.
✓		inside trailer	29. Cleanup area clean and protected from wind.
✓			30. Train inspected for abnormalities prior to disassembly.
✓			31. Adsorbant tubes capped with ground glass caps and wrapped in aluminum foil.
✓			32. Impingers wiped dry, weighted, and weight recorded.
✓			33. Analytical balance calibration check performed routinely. Check weights, in correct range and recorded.
		contents put into correct contain	34. Contents of impingers composited into proper sample containers and containers sealed.
✓			35. Appropriate solvent rinse sequence followed adequately.
✓			36. Containers labelled per test plan protocol.

(Continued)

Table C-5. MODIFIED METHOD 5 SAMPLING CHECKLIST
(Continued)

Yes	No	Comments	Operation
✓			37. Samples collected in amber glass bottles with TFE-lined screw caps.
✓			38. Appropriate chain of custody records maintained on each sample component.

APPENDIX D

CEM DATA

CEMS DATA - SITE 07 - TEST 1

FACTOR FOR 3% O2 NORMALIZATION OF OTHER PROCESS GASES	NORMALIZED / CORRECTED DATA - WITH ACTUAL O2					
	TIME	O2 (%V)	CO (PPMV)	CO2 (%V)	NOX (PPMV)	THC (PPMV)
2.4107	1415	13.5	237.0	18.7	0.5	
2.4327	1420	13.5	176.0	18.3	0.0	0.1
2.4482	1425	13.6	224.1	18.7	0.0	
2.4500	1430	13.6	183.9	18.4		0.1
2.3375	1435	13.2	170.9	18.1	0.0	
2.5239	1440	13.8	123.0	18.3	0.5	.0
2.5341	1445	13.8	182.9	18.8	0.8	0.3
2.5556	1450	13.9	150.0	18.4	0.0	0.2
2.3786	1455	13.4	202.2	17.9	0.5	0.4
2.5852	1500	14.0	253.9	18.3	0.0	0.4
2.5834	1505	14.0	174.5	18.3	0.5	0.3
2.4595	1510	13.6	276.1	17.8	0.0	0.6
2.4967	1515	13.7	145.2	18.0	0.0	0.5
2.5076	1520	13.8	108.3	18.7	0.0	0.6
2.5113	1525	13.8	242.7	18.3	0.8	0.4
2.3568	1530	13.3	220.9	17.3	0.0	0.4
2.4980	1535	13.7	183.6	17.8	0.7	0.5
2.4786	1540	13.7	221.5	18.4	0.5	0.3
2.4534	1545	13.6	385.6	18.8	0.0	0.3
2.4744	1550	13.7	259.8	17.9	0.5	0.4
2.5450	1555	13.9	335.4	18.3	0.0	0.5
2.6070	1600	14.0	256.5	18.6	0.0	0.4
2.4521	1605	13.6	244.4	18.1	0.7	0.5
2.5196	1610	13.8	232.1	17.7	0.8	0.4
2.4847	1615	13.7	340.0	17.6	0.0	0.4
2.4559	1620	13.6	251.4	18.5	0.0	0.4
2.4295	1625	13.5	163.9	18.2	0.0	0.3
2.4111	1630	13.5	293.0	18.0	0.5	0.5
2.4054	1635	13.5	251.0	18.6	0.0	0.4
2.4172	1640	13.5	284.2	18.4	0.0	0.5
2.4444	1645	13.6	260.0	17.9	0.0	0.3
2.5325	1650	13.8	153.9	18.6	0.5	0.4
2.5483	1655	13.9	117.8	18.8	0.5	0.5
2.4795	1700	13.7	182.7	18.2	0.7	0.3
2.4912	1705	13.7	253.1	17.7		0.5
2.3104	1710	13.2	173.6	17.5	0.0	0.5
2.4985	1715	13.7	141.1	18.2	0.7	0.5
2.3456	1720	13.3	177.6	19.1	1.6	0.3
2.2251	1725	12.9	249.2	17.4	0.0	0.3
2.2851	1730	13.1	180.2	17.8	0.0	0.4
3.1956	1735	15.3	333.0	26.0	0.6	0.5
2.1974	1740	12.8	306.4	18.2	0.4	0.4
2.2951	1745	13.1	259.6	18.1	0.7	0.4
2.1481	1750	12.6	32.4	17.5	1.1	0.3
2.1649	1755	12.6	213.9	18.4	0.6	0.1
2.1998	1800	12.8	187.1	18.0	0.4	0.2
2.2525	1805	13.0	59.0	18.2	0.5	0.2
2.2147	1810	12.8	260.5	17.6	0.0	0.3
2.2563	1815	13.0	344.2	18.3	0.0	.0
2.2092	1820	12.8	288.5	17.8	0.4	0.1
2.3517	1825	13.3	419.8	18.0	0.5	0.1
2.2356	1830	12.9	215.6	18.5	0.0	0.2
2.4357	1835	13.6		18.3	0.0	.0
2.1131	1840	12.4	286.7	17.8	0.6	
2.4140	1845	13.5	161.0	17.9	0.5	
2.2762	1850	13.0	79.0	18.1	0.0	
2.2275	1855	12.9		18.4	0.0	
2.3461	1900	13.3	23.7	18.9	0.0	
2.2787	1905	13.0	60.5	18.3	0.5	
2.2968	1910	13.1	91.2	17.8	0.5	
2.2144	1915	12.8	296.0	18.6	0.0	
2.2539	1920	13.0		18.6	0.5	
2.0523	1925	12.2	238.9	18.8	0.6	
2.0572	1930	12.2	199.7	18.1	0.4	
2.0179	1935	12.0	357.0	18.7	0.0	0.3
2.1506	1940	12.6		18.6	0.0	0.1
2.0429	1945	12.1	166.8	18.2	0.0	0.1
2.1595	1950	12.6	167.1	18.2	0.0	0.1
2.1915	1955	12.7	165.9	18.7	0.0	0.3
2.1718	2000	12.7	95.3	18.5	0.0	0.2
2.2518	2005	13.0		18.3	0.0	0.3
NO. PTS. 71	NO. PTS.	71	66	71	69	57
MEAN 2.3667	MEAN	13.3	211.7	18.3	0.3	0.3
STD. DEV. 0.2	STD. DEV.	0.6	82.8	1.0	0.3	0.1

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CEMS DATA - SITE 07 - TEST 2

	FACTOR FOR 3% O2 NORMALIZATION OF OTHER PROCESS GASES	NORMALIZED / CORRECTED DATA - WITH ACTUAL O2					
		TIME	O2 (%V)	CO (PPMV)	CO2 (%V)	NOX (PPMV)	THC (PPMV)
	2.0801	1040	12.3	100.6	18.1	0.4	7.4
	1.8975	1045	11.5	233.1	17.8	0.3	6.0
	2.5775	1050	14.0	230.5	18.0	0.9	8.0
	2.0351	1055	12.1	175.2	18.0	0.0	6.0
	2.0013	1100	12.0	271.0	17.9	0.3	6.0
	1.9531	1105	11.7	305.4	17.7	0.3	6.0
	2.6550	1110	14.2	300.7	18.7	0.0	7.0
	2.0199	1115	12.0	245.4	17.8	0.3	5.7
	2.0070	1120	12.0	207.3	17.7	0.0	5.9
	2.7167	1125	14.3	279.5	18.1	0.0	7.4
	1.9979	1130	11.9	254.9	17.8	0.3	5.4
	1.9975	1135	11.9	201.0	17.0	0.3	5.2
	2.6006	1140	14.0	357.3	17.0	0.4	7.0
	2.0239	1145	12.1	269.4	17.9	0.0	5.7
	2.0493	1150	12.2	289.5	17.6	0.4	5.6
	2.4621	1155	13.6	322.9	16.9	0.4	6.3
	2.0880	1200	12.3	333.0	18.3	0.0	5.6
	2.0027	1205	12.0	259.6	17.5	0.0	5.9
	1.9941	1210	11.9	283.1	17.5	0.3	5.2
	2.6430	1215	14.1	207.7	17.7	0.0	6.6
	1.9923	1220	11.9	269.3	17.6	0.3	4.9
	2.0604	1225	12.2	275.3	17.4	0.0	5.7
	2.7705	1230	14.4	302.8	17.0	0.0	6.6
	2.1052	1235	12.4	235.3	17.4	0.0	4.6
	2.0740	1240	12.3	197.5	17.4	0.0	4.7
	2.5553	1245	13.9	282.2	17.1	0.4	5.8
	2.1230	1250	12.5	240.1	18.0		4.8
	2.0674	1255	12.2	283.1	17.5	0.4	5.0
	2.1076	1300	12.4	292.0	16.0	0.0	5.2
	2.5503	1305	13.9	310.7	18.9	0.4	5.4
	2.1007	1310	12.4	257.1	17.4	0.0	4.2
	2.1039	1315	12.4	261.2	17.3	1.1	3.7
	2.7398	1320	14.4	322.5	17.5	0.5	5.0
	2.1176	1325	12.4	241.4	17.4	0.0	3.9
	2.0681	1330	12.2	284.1	17.5	0.0	3.4
	2.7573	1335	14.4	262.1	17.6	0.0	4.1
	2.0391	1340	12.1	212.8	17.4	0.4	2.7
	2.0576	1345	12.2	187.6	17.7	0.0	2.4
	2.2000	1350	12.8	193.2	16.6	0.8	2.4
	2.6034	1355	14.0	191.3	18.7	0.5	2.8
	2.0732	1400	12.3	190.5	17.5	0.7	2.3
	2.1269	1405	12.5	155.4	17.5	0.0	1.0
	2.9853	1410	14.9	135.4	18.0	0.5	1.9
	2.0447	1415	12.1	149.8	17.0	0.4	1.6
	2.1665	1420	12.6	96.3	17.6	0.7	1.3
	2.8568	1425	14.6	135.2	18.2	0.0	1.6
	2.1434	1430	12.5	135.0	17.7	0.0	1.3
	2.0637	1435	12.2	151.4	18.0	0.0	2.4
	2.6636	1440	14.2	149.0	17.3	0.0	2.7
	2.4320	1445	13.5	175.4	18.3	0.0	1.6
	2.4632	1450	13.6	211.7	18.2	0.9	1.2
	2.1650	1455	12.6	212.1	17.9	0.0	0.9
NO. PTS.	52	NO. PTS.	52	52	52	51	52
MEAN	2.2538	MEAN	12.0	239.0	17.7	0.2	4.5
STD. DEV.	0.3	STD. DEV.	0.9	60.7	0.4	0.3	2.0

```
CEMS DATA - SITE 07 - TEST 3

**    FACTOR               **         NORMALIZED / CORRECTED DATA - WITH ACTUAL O2
**    FOR 3% O2            **
**    NORMALIZATION        **
**         OF              **    TIME        O2        CO       CO2       NOX       THC
**    OTHER PROCESS        **               (%V)    (PPMV)     (%V)    (PPMV)    (PPMV)
**       GASES             **
**                         **  -------   -------   -------   -------   -------   -------
**    ----------           **

**       2.3113            **    1000      13.2     357.9      17.4       0.4       2.6
**       3.1547            **    1005      15.2     417.7      17.6       0.0       2.3
**       2.3335            **    1010      13.2     292.8      17.3       0.0       1.0
**       2.3002            **    1015      13.1     339.8      17.3       0.0       1.6
**       3.1311            **    1020      15.2     350.0      17.5       0.5       1.4
**       2.2993            **    1025      13.1     316.5      17.6       0.0       0.0
**       2.3509            **    1030      13.3     326.9      17.3       0.0       0.3
**       2.7384            **    1035      14.4     339.6      16.4       0.9       0.2
**       2.5970            **    1040      14.0     331.5      18.7       0.4       0.2
**       2.2793            **    1045      13.0     345.1      17.5       0.4       0.2
**       2.3290            **    1050      13.2     342.7      17.5       0.4       0.3
**       3.0852            **    1055      15.1     400.9      17.6       0.0       0.5
**       2.3263            **    1100      13.2     314.9      17.5       0.0       0.4
**       2.3146            **    1101      13.2     321.7      17.5       0.0       0.2
**       3.0119            **    1102      15.0     373.6      17.7       0.5       0.2
**       2.3062            **    1103      13.1     333.8      17.4       0.0       0.1
**       2.2435            **    1104      12.9     323.9      17.4       0.0       0.4
**       2.8563            **    1105      14.6     432.1      17.2       0.0       0.0
**       2.2786            **    1106      13.0     341.3      17.7       0.4       0.3
**       2.3677            **    1107      13.3     319.2      17.5       0.0       0.2
**       2.1143            **    1108      12.4     269.6      17.4       0.4       0.1
**       2.9401            **    1109      14.8     349.8      18.3       0.0       0.2
**       2.2870            **    1110      13.1     322.7      17.6       0.7       0.2
**       2.2210            **    1111      12.8     279.3      17.5       0.0       0.3
**       2.9954            **    1112      14.9     297.6      17.0       1.0       0.0
**       2.2807            **    1200      13.1     295.2      17.6       0.7       1.0
**       2.0421            **    1205      12.1     326.5      17.8       0.3       0.9
**       2.7316            **    1210      14.3     370.1      17.7       1.4       0.4
**       2.1486            **    1215      12.6     301.6      17.4       0.0       0.2
**       2.1380            **    1220      12.5     311.1      17.3       0.4       0.1
**       2.2221            **    1225      12.8     304.5      16.5       0.4       0.1
**       2.5446            **    1230      13.9     318.8      18.6       0.0       0.1
**       2.1233            **    1235      12.5     310.0      17.4       1.1       0.2
**       2.0235            **    1240      12.1     280.2      17.5       0.3       0.3
**       2.6270            **    1245      14.1     306.3      17.6       0.0       0.6
**       2.0513            **    1250      12.2     305.0      17.5       0.3       0.2
**       2.0613            **    1255      12.2     295.0      17.6       0.0       0.2
**       2.6842            **    1300      14.2     327.5      17.6       0.5       0.4
**       2.2385            **    1305      12.9     242.0      17.5       0.0       0.4
**       2.1756            **    1310      12.7     280.5      17.7       0.0       0.3
**       2.8076            **    1315      14.5     345.0      17.5       0.5       0.3
**       2.1252            **    1320      12.5     411.6      18.0       0.4       0.2
**       1.6932            **    1325      10.3    2046.3      17.3       0.0      29.0
**       1.8944            **    1330      11.5     305.7      17.9       0.0       0.3
**       2.4940            **    1335      13.7     269.7      18.0       0.0       0.2
**       1.7861            **    1340      10.9     367.2      17.9       0.0       0.5
**       1.8322            **    1345      11.1     291.9      17.7       0.3       0.5
**       2.3591            **    1350      13.3     472.2      18.2       0.4       1.3
**       1.9167            **    1355      11.6     257.9      18.0       0.0       0.1
**       1.7717            **    1400      10.8     625.2      17.8       0.9       0.0
**       2.4040            **    1405      13.5     494.2      18.0       1.2        .0
**       1.7940            **    1410      10.9     700.0      18.2       0.0       0.7
**       1.8900            **    1415      11.4     321.1      18.0       0.3       1.5
**       2.1386            **    1420      12.5     396.0      17.0       0.0       0.3
**       2.0300            **    1425      12.1     423.5      19.3       0.7       0.1
**       1.8670            **    1430      11.3     250.5      18.0       0.0       0.9
**       1.8415            **    1435      11.2     333.6      18.2       0.0       0.5
**       2.5625            **    1440      13.9     198.1      17.9       0.0       1.6
**       1.9797            **    1445      11.9     219.0      18.2       1.0       0.6
**       1.8641            **    1450      11.3     286.3      18.0       0.0       1.5
**       2.5851            **    1455      14.0     280.0      18.3       0.0       1.1
=========================================================================================

NO. PTS.          61              NO. PTS.        61        61        61        61        61
MEAN          2.3097              MEAN          13.0     366.5      17.7       0.3       1.0
STD. DEV.        0.4              STD. DEV.      1.2     234.4       0.5       0.4       3.7
```

CEMS DATA - SITE 07 - TEST 1 (UNREDUCED TO 3% O2)

TIME	O2 (%V)	CO (PPMV)	CO2 (%V)	NOX (PPMV)	THC (PPMV)
=======	=======	=======	=======	=======	=======
1415	13.5	98.3	7.8	0.2	.0
1420	13.5	72.4	7.5	0.0	.0
1425	13.6	91.5	7.6	0.0	.0
1430	13.6	75.1	7.5		.0
1435	13.2	73.1	7.8	0.0	.0
1440	13.8	48.7	7.3	0.2	.0
1445	13.8	72.2	7.4	0.3	0.1
1450	13.9	58.7	7.2	0.0	0.1
1455	13.4	85.0	7.5	0.2	0.2
1500	14.0	98.2	7.1	0.0	0.2
1505	14.0	67.5	7.1	0.2	0.1
1510	13.6	112.2	7.2	0.0	0.2
1515	13.7	58.2	7.2	0.0	0.2
1520	13.8	43.2	7.4	0.0	0.3
1525	13.8	96.6	7.3	0.3	0.2
1530	13.3	93.7	7.3	0.0	0.2
1535	13.7	73.5	7.1	0.3	0.2
1540	13.7	89.4	7.4	0.2	0.1
1545	13.6	157.2	7.7	0.0	0.1
1550	13.7	105.0	7.2	0.2	0.1
1555	13.9	131.8	7.2	0.0	0.2
1600	14.0	98.4	7.1	0.0	0.1
1605	13.6	99.6	7.4	0.3	0.2
1610	13.8	92.1	7.0	0.3	0.2
1615	13.7	136.8	7.1	0.0	0.2
1620	13.6	102.4	7.5	0.0	0.1
1625	13.5	67.5	7.5	0.0	0.1
1630	13.5	121.5	7.5	0.2	0.2
1635	13.5	104.3	7.7	0.0	0.2
1640	13.5	117.6	7.6	0.0	0.2
1645	13.6	106.4	7.3	0.0	0.1
1650	13.8	60.8	7.3	0.2	0.2
1655	13.9	46.2	7.4	0.2	0.2
1700	13.7	73.7	7.3	0.3	0.1
1705	13.7	101.6	7.1		0.2
1710	13.2	75.2	7.6	0.0	0.2
1715	13.7	56.5	7.3	0.3	0.2
1720	13.3	75.7	8.2	0.7	0.1
1725	12.9	112.0	7.8	0.0	0.1
1730	13.1	78.9	7.8	0.0	0.2
1735	15.3	104.2	8.1	0.2	0.1
1740	12.8	139.5	8.3	0.2	0.2
1745	13.1	113.1	7.9	0.3	0.2
1750	12.6	15.1	8.2	0.5	0.2
1755	12.6	98.8	8.5	0.3	0.1
1800	12.8	85.0	8.2	0.2	0.1
1805	13.0	26.2	8.1	0.2	0.1
1810	12.8	117.6	8.0	0.0	0.1
1815	13.0	152.6	8.1	0.0	.0
1820	12.8	130.6	8.1	0.2	0.1
1825	13.3	178.5	7.6	0.2	0.1
1830	12.9	96.4	8.3	0.0	0.1
1835	13.6		7.5	0.0	.0

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        CEMS DATA - SITE 07 - TEST 1 (UNREDUCED TO 3% O2)

             1840      12.4    135.7       8.4       0.3        .0
             1845      13.5     66.7       7.4       0.2
             1850      13.0     34.7       8.0       0.0        .0
             1855      12.9                8.2       0.0        .0
             1900      13.3     10.1       8.1       0.0
             1905      13.0     26.5       8.1       0.2
             1910      13.1     39.7       7.7       0.2
             1915      12.8    133.7       8.4       0.0
             1920      13.0                8.3       0.2
             1925      12.2    116.4       9.1       0.3        .0
             1930      12.2     97.1       8.8       0.2        .0
             1935      12.0    176.9       9.3       0.0       0.1
             1940      12.6                8.7       0.0        .0
             1945      12.1     81.6       8.9       0.0       0.1
             1950      12.6     77.4       8.4       0.0        .0
             1955      12.7     75.7       8.5       0.0       0.1
             2000      12.7     43.9       8.5       0.0       0.1
             2005      13.0                8.1       0.0       0.1
                ================================================================

        NO. PTS.         71       66        71        71        57
          MEAN         13.3     89.4       7.8       0.1       0.1
        STD. DEV.       0.6     35.7       0.5       1.3       0.1
```

CEMS DATA - SITE 07 - TEST 2 (UNREDUCED TO 3% O2)

TIME	O2 (%V)	CO (PPMV)	CO2 (%V)	NOX (PPMV)	THC (PPMV)
1040	12.3	86.8	8.7	0.2	3.6
1045	11.5	122.8	9.4	0.2	3.2
1050	14.0	89.4	7.0	0.3	3.1
1055	12.1	86.1	8.9	0.0	2.9
1100	12.0	135.8	8.9	0.2	3.0
1105	11.7	156.3	9.1	0.2	3.1
1110	14.2	116.3	7.0	0.0	2.9
1115	12.0	121.5	8.8	0.2	2.8
1120	12.0	143.1	8.8	0.0	3.0
1125	14.3	102.9	6.6	0.0	2.7
1130	11.9	127.6	8.9	0.2	2.7
1135	11.9	140.7	8.9	0.2	2.6
1140	14.0	137.0	6.8	0.2	2.7
1145	12.1	133.1	8.8	0.0	2.8
1150	12.2	141.3	8.6	0.2	2.8
1155	13.6	131.1	6.9	0.2	2.6
1200	12.3	159.5	8.8	0.0	2.7
1205	12.0	129.6	8.8	0.0	3.0
1210	11.9	142.0	8.8	0.2	2.6
1215	14.1	108.8	6.7	0.0	2.5
1220	11.9	135.2	8.8	0.2	2.4
1225	12.2	133.6	8.5	0.0	2.8
1230	14.4	109.3	6.4	0.0	2.4
1235	12.4	111.8	8.3	0.0	2.2
1240	12.3	95.2	8.4	0.0	2.3
1245	13.9	110.5	6.7	0.2	2.3
1250	12.5	113.0	8.5		2.3
1255	12.2	136.9	8.5	0.2	2.4
1300	12.4	138.6	8.0	0.0	2.5
1305	13.9	125.0	7.4	0.2	2.1
1310	12.4	121.9	8.3	0.0	2.0
1315	12.4	124.1	8.2	0.5	1.8
1320	14.4	117.7	6.4	0.2	1.8
1325	12.4	114.0	8.2	0.0	1.8
1330	12.2	137.4	8.5	0.0	1.6
1335	14.4	95.1	6.4	0.0	1.5
1340	12.1	104.3	8.6	0.2	1.3
1345	12.2	91.2	8.6	0.0	1.2
1350	12.8	87.8	7.5	0.3	1.1
1355	14.0	73.5	7.2	0.2	1.1
1400	12.3	95.7	8.4	0.3	1.1
1405	12.5	73.1	8.2	0.0	0.9
1410	14.9	45.3	6.0	0.2	0.6
1415	12.1	73.3	8.7	0.2	0.8
1420	12.6	44.4	8.1	0.3	0.6
1425	14.6	47.3	6.4	0.0	0.6
1430	12.5	63.0	8.2	0.0	0.6
1435	12.2	73.4	8.7	0.0	1.1
1440	14.2	55.9	6.5	0.0	1.0
1445	13.5	72.1	7.5	0.0	0.6
1450	13.6	86.0	7.4	0.3	0.5
1455	12.6	97.9	8.2	0.0	0.4

CEMS DATA - SITE 07 - TEST 2 (UNREDUCED TO 3% O2)

NO. PTS.	52	52	52	51	52
MEAN	12.8	108.0	8.0	0.1	2.0
STD. DEV.	0.9	29.1	0.9	0.1	0.9

CEMS DATA - SITE 07 - TEST 3 (UNREDUCED TO 3% O2)

TIME	O2 (%V)	CO (PPMV)	CO2 (%V)	NOX (PPMV)	THC (PPMV)
=======	=======	=======	=======	=======	=======
1000	13.2	154.9	7.5	0.2	1.1
1005	15.2	132.4	5.6	0.0	0.7
1010	13.2	125.5	7.4	0.0	0.8
1015	13.1	147.7	7.5	0.0	0.7
1020	15.2	114.4	5.6	0.2	0.5
1025	13.1	137.6	7.6	0.0	0.4
1030	13.3	139.0	7.4	0.0	0.1
1035	14.4	124.0	6.0	0.3	0.1
1040	14.0	127.6	7.2	0.2	0.1
1045	13.0	151.4	7.7	0.2	0.1
1050	13.2	147.1	7.5	0.2	0.1
1055	15.1	132.5	5.7	0.0	0.2
1100	13.2	135.4	7.5	0.3	0.2
1101	13.2	139.0	7.6	0.0	0.1
1102	15.0	124.0	5.9	0.2	0.1
1103	13.1	144.7	7.6	0.0	0.1
1104	12.9	144.4	7.8	0.0	0.2
1105	14.6	151.3	6.0	0.0	0.3
1106	13.0	149.8	7.8	0.2	0.1
1107	13.3	134.8	7.4	0.0	0.1
1108	12.4	127.5	8.2	0.2	0.1
1109	14.8	119.0	6.2	0.0	0.1
1110	13.1	141.1	7.7	0.3	0.1
1111	12.8	125.7	7.9	0.0	0.1
1112	14.9	99.4	5.9	0.3	0.3
1200	13.1	129.4	7.7	0.3	0.5
1205	12.1	159.9	8.7	0.2	0.4
1210	14.3	135.5	6.5	0.5	0.2
1215	12.6	140.3	8.1	0.0	0.1
1220	12.5	145.5	8.1	0.2	.0
1225	12.8	137.0	7.4	0.2	.0
1230	13.9	125.3	7.3	0.0	.0
1235	12.5	149.8	8.2	0.5	0.1
1240	12.1	138.5	8.6	0.2	0.2
1245	14.1	116.6	6.7	0.0	0.2
1250	12.2	149.1	8.5	0.2	0.1
1255	12.2	143.5	8.5	0.0	0.1
1300	14.2	122.0	6.5	0.2	0.1
1305	12.9	108.5	7.8	0.0	0.2
1310	12.7	128.9	8.1	0.0	0.1
1315	14.5	122.9	6.2	0.2	0.1
1320	12.5	193.7	8.5	0.2	0.1
1325	10.3	1208.5	10.2	0.5	17.1
1330	11.5	161.3	9.4	0.0	0.2
1335	13.7	108.1	7.2	0.0	0.1
1340	10.9	205.6	10.0	0.0	0.3
1345	11.1	159.3	9.7	0.2	0.3
1350	13.3	200.2	7.7	0.2	0.5
1355	11.6	134.5	9.4	0.0	.0
1400	10.8	352.9	10.0	0.5	0.4
1405	13.5	205.5	7.5	0.5	.0
1410	10.9	439.5	10.1	0.0	0.4
1415	11.4	169.9	9.5	0.2	0.8

CEMS DATA - SITE 07 - TEST 3 (UNREDUCED TO 3% O2)

1420	12.5	186.3	8.0	0.0	0.1
1425	12.1	208.6	9.5	0.3	.0
1430	11.3	134.1	9.7	0.0	0.5
1435	11.2	181.1	9.9	0.0	0.3
1440	13.9	77.3	7.0	0.0	0.6
1445	11.9	110.6	9.2	0.5	0.3
1450	11.3	153.6	9.7	0.0	0.8
1455	14.0	80.8	7.1	0.0	0.4
NO. PTS.	61	61	61	61	61
MEAN	13.0	167.1	7.8	0.1	0.5
STD. DEV.	1.2	144.6	1.2	0.2	2.2

APPENDIX E

WOOD FEED HEAT CONTENT ANALYSES

464

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES. 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953 9300

LLOYD W. TAYLOR III
MANAGER
MIDWEST DIVISION

PLEASE ADDRESS ALL CORRESPONDENCE TO
16130 VAN DRUNEN RD., P.O. BOX 127
SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173
TELEX: 283527

RADIAN CORPORATION
Process Center
3200 E. Chapel Hill Rd./Nelson Hwy
P.O. Box 13000
Research Triangle Park, NC 27709
ATTN: Winton Kelly

May 30, 1985

Sample identification by Radian Corp.

Kind of sample reported to us: Wood

Sample taken at: -----

Sample taken by: Radian Corp.

Date sampled: 4/16/85

Date received: 5/24/85

Sample Type: 07-WF-01-D
Location: #7 BLR
Date: 4/16/85
Sample No.: 9149

Project #231-056-12-09

P.O. No. V-19098

Analysis report no. 71-07443

ULTIMATE ANALYSIS

	As Rec'd	Dry Basis
%Moisture	4.74	XXXXX
%Carbon	51.61	54.18
%Hydrogen	5.59	5.87
%Nitrogen	0.10	0.10
%Chlorine	0.31	0.33
%Sulfur	0.13	0.14
%Ash	0.66	0.69
%Oxygen(diff)	36.86	38.69
	100.00	100.00
Btu/lb.	8613	9042

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

David W. Cox

David W. Cox, Manager, South Holland Laboratory

Charter Member

l Copy Watermarked
Your Protection

/ds

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300

LLOYD W. TAYLOR III
MANAGER
MIDWEST DIVISION

PLEASE ADDRESS ALL CORRESPONDENCE TO:
16130 VAN DRUNEN RD., P.O. BOX 127
SOUTH HOLLAND, IL 60473
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TELEX: 283527

RADIAN CORPORATION
Process Center
3200 E. Chapel Hill Rd./Nelson Hwy
P.O. Box 13000
Research Triangle Park, NC 27709
ATTN: Winton Kelly

May 30, 1985

Sample identification by Radian Corp.

Kind of sample reported to us: Wood
Sample taken at: -----
Sample taken by: Radian Corp.
Date sampled: 4/17/85
Date received: 5/24/85

Sample Code: 07-WF-02-D-B
Location: Wood Fuel
Screw Feeder
Date: 4/17/85

Project #231-056-12-09

P.O. No. V-19098

Analysis report no. 71-07445

ULTIMATE ANALYSIS

	As Rec'd	Dry Basis
%Moisture	4.01	XXXXX
%Carbon	51.66	53.82
%Hydrogen	5.66	5.90
%Nitrogen	0.08	0.08
%Chlorine	0.28	0.29
%Sulfur	0.14	0.15
%Ash	0.65	0.68
%Oxygen(diff)	37.52	39.08
	100.00	100.00
Btu/lb.	8501	8856

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

David W. Cox

David W. Cox, Manager, South Holland Laboratory

Charter Me

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For Your Protection

DWC/ds

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300

LLOYD W. TAYLOR III
MANAGER
MIDWEST DIVISION

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO:
16130 VAN DRUNEN RD., P.O. BOX 127
SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173
TELEX: 283527

RADIAN CORPORATION
Process Center
3200 E. Chapel Hill Rd./Nelson Hwy
P.O. Box 13000
Research Triangle Park, NC 27709
ATTN: Winton Kelly

May 30, 1985

Sample identification by Radian Corp.

Kind of sample reported to us: Wood

Sample taken at: -----

Sample taken by: Radian Corp.

Date sampled: 4/17/85

Date received: 5/24/85

Sample Type: 07-WF-02-D
Location: Wood Fuel Screw Feeder
Date: 4/17/85
Sample No.: 9142

Project #231-056-12-09

P.O. No. V-19098

Analysis report no. 71-07444

ULTIMATE ANALYSIS

	As Rec'd	Dry Basis
%Moisture	3.88	XXXXX
%Carbon	51.75	53.84
%Hydrogen	5.57	5.80
%Nitrogen	0.08	0.08
%Chlorine	0.31	0.32
%Sulfur	0.12	0.13
%Ash	0.68	0.71
%Oxygen(diff)	37.61	39.12
	100.00	100.00
Btu/lb.	8169	8499

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

David W. Cox

David W. Cox, Manager, South Holland Laboratory

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OFFICE TEL. (312) 264-1173
TELEX: 283527

RADIAN CORPORATION
Process Center
3200 E. Chapel Hill Rd./Nelson Hwy
P.O. Box 13000
Research Triangle Park, NC 27709
ATTN: Winton Kelly

May 30, 1985

Sample identification by Radian Corp.

Kind of sample reported to us	Wood
Sample taken at	-----
Sample taken by	Radian Corp.
Date sampled	4/18/85
Date received	5/24/85

Sample Type: 07-WF-03-D
Location: Wood Fuel Screw Conveyor
Date: 4/18/85
Sample No.: 9141

Project #231-056-12-09

P.O. No. V-19098

Analysis report no. 71-07446

ULTIMATE ANALYSIS

	As Rec'd	Dry Basis
%Moisture	4.40	XXXXX
%Carbon	52.13	54.53
%Hydrogen	5.70	5.96
%Nitrogen	0.08	0.08
%Chlorine	0.25	0.26
%Sulfur	0.13	0.14
%Ash	0.60	0.63
%Oxygen(diff)	36.71	38.40
	100.00	100.00
Btu/lb.	8736	9138

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

David W. Cox

David W. Cox, Manager, South Holland Laboratory

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APPENDIX F

TESTING PERSONNEL

TESTING PERSONNEL

Winton Kelly*	Radian
Bob Jongleux	Radian
Jim McReynolds	Radian
Dave Savia	Radian
Dave P. Dayton	Radian
Lee Garcia	Radian
Carol Jamgochian	Radian
Gary Henry	Radian

*Field Engineer

APPENDIX G
ERROR ANALYSIS: CONTROL DEVICE EFFICIENCY CALCULATIONS

Objective: Given the analytical uncertainty of the dioxin/furan analyses (± 50% accuracy), estimate the uncertainty of the control device efficiency calculations.

Let: $C_{out,meas}$ = the measured concentration of a given dioxin/furan homologue at the outlet location.

$C_{in,meas}$ = the measured concentration of a given dioxin/furan homologue at the inlet location.

$C_{out,max}$ = the maximum possible concentration of the dioxin/furan homologue given the measured value $C_{out,meas}$.

$C_{out,min}$ = the minimum possible concentration of the dioxin/furan homologue given the measured value $C_{out,meas}$.

$C_{in,max}$ = the maximum possible concentration of the dioxin/furan homologue, given the measured value $C_{in,meas}$.

$C_{in,min}$ = the minimum possible concentration of the dioxin/furan homologue, given the measured value $C_{in,meas}$.

E = the removal efficiency of the control device

Assuming ± 50 percent analytical accuracy:

$$C_{min} = C_{meas} - 0.5\ C_{meas} = 0.5\ C_{meas}$$

$$C_{max} = C_{meas} + 0.5\ C_{meas} = 1.5\ C_{meas}$$

Note that:

$$E_{max} = \frac{C_{in,max} - C_{out,min}}{C_{in,max}} = 1 - \frac{C_{out,min}}{C_{in,max}}$$

$$E_{max} = 1 - \frac{0.5\ C_{out,meas}}{1.5\ C_{in,meas}} = 1 - {}^{1}/_{3}\ (1 - E_{meas})$$

$$= {}^{2}/_{3} + {}^{1}/_{3}\ E_{meas}$$

and:

$$E_{min} = \frac{C_{in,min} - C_{out,max}}{C_{in,min}} = 1 - \frac{C_{out,max}}{C_{in,min}}$$

$$= 1 - \frac{1.5\ C_{out,meas}}{0.5\ C_{in,meas}}$$

$$= 1 - 3\ (1 - E_{meas})$$

$$E_{min} = 3\ E_{meas} - 2$$

Now, $E_{min} > 0$ positive control (i.e., emissions reduction across the control device)

$$(3E_{meas} - 2) > 0$$

$$E_{meas} > {}^{2}/_{3}$$

Therefore, if E_{meas} is larger than 66.7 percent, the true removal efficiency can safely be assumed to be greater than zero.

And, $E_{max} < 0$ negative control (i.e., emissions increase across the control device)

$${}^{2}/_{3} + {}^{1}/_{3}\ E_{meas} < 0$$

$$E_{meas} < -2$$

Therefore, if E_{meas} is less than -200 percent, the true efficiency can safely be assumed to be less than zero.

To summarize:

$E_{meas} > 66.7$ percent	positive control
$-200 < E_{meas} < 66.7$ percent	no definitive conclusions can be drawn
$E_{meas} < 200$ percent	no negative control

TABLE G.1 VALUES OF E_{max} and E_{min} FOR VARIOUS MEASURED CONTROL EFFICIENCIES

Control Device Efficiency (%)		
E_{meas}	E_{max}	E_{min}
100	100	100
95	98.3	85
90	96.7	70
85	95.0	55
80	93.4	40
75	91.7	25
50	83.4	-50
25	75.0	-125
0	66.7	-200
-25	58.4	-275
-50	50.0	-350
-100	33.4	-500
-200	0	-800

$$E_{max} = (200 + E_{meas})/3$$

$$E_{min} = 3E_{meas} - 200$$

APPENDIX H
SAMPLE SHIPMENT LETTERS

April 19,1985

U. S. EPA ECC Toxicant Analysis Center
Building 1105
Bay St. Louis, MS 39529

Attention: Danny McDaniel

Subject: Tier 4 - Analysis Instructions
Site 07

Dear Sir:

The objective of this letter is to clarify instructions and priorities for individual samples from specific Tier 4 combustion sites. This instruction letter is No. 7 and pertains to EPA Site No. 07.

The Episode No. is 2633, and SCC numbers assigned to this site were numbers DQ000901 through DQ000999.

SCC numbers DQ000901 through DQ000906 have been assigned to Troika for internal QA/QC purposes. SCC numbers DQ000907 through DQ000929 have been assigned to samples included in this shipment and number DQ000930 have been assigned to samples being archived at Radian. All remaining SCC numbers are unused.

The sample shipment for EPA Site No. 07 consists of 4 boxes containing 65 samples in 68 containers.(Note-The Modified Method 5 samples are comprised of 6 components as listed below.One (1) MM5 sample runs has more than one container per component as indicated by asterisk.) The sample shipment was shipped air freight on April 20 ,1985 by Federal Express under Airbill(s) No.289783421 and No.540721016

Instructions for extraction and analysis follow.

1. Priority # 1 samples include the sample train components, the baghouse dust, the boiler bottom ash, the laboratory (proof)train blank, train coponents, and reagent blanks.These samples require immediate extraction and analysis, as follows:

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Radian Run #07-MM5-BI-01
(Total of 6 train components)

SCC #	Component	Fraction
DQ000908	1	Filter
DQ000908	2*(2 containers)	Probe Rinse
DQ000908	3	Back Half/Coil Rinse
DQ000908	4	Condensate
DQ000908	5	Impinger Solution
DQ000908	6	XAD Module

Radian Run # 07-MM5-BO-01
(Total of 6 train components)

SCC #	Components	Fraction
DQ000909	1	Filter
DQ000909	2	Probe Rinse
DQ000909	3	Back Half/Coil Rinse
DQ000909	4	Condensate
DQ000909	5	Impinger Solution
DQ000909	6	XAD Module

Radian Run # 07-MM5-BI-02
(Total of 6 train components)

SCC #	Components	Fraction
DQ000918	1	Filter
DQ000918	2	Probe Rinse
DQ000918	3	Back Half/Coil Rinse
DQ000918	4	Condensate
DQ000918	5	Impinger Solution
DQ000918	6	XAD Module

Radian Run # 07-MM5-BO-02
(Total of 6 train components)

SCC #	Components	Fraction
DQ000919	1	Filter
DQ000919	2	Probe Rinse
DQ000919	3	Back Half/Coil Rinse
DQ000919	4	Condensate
DQ000919	5	Impinger Solution
DQ000919	6	XAD Module

Radian Run # 07-MM5-BI-03
(Total of 6 train components)

SCC #	Components	Fraction
DQ000920	1	Filter
DQ000920	2	Probe Rinse
DQ000920	3	Back Half/Coil Rinse
DQ000920	4	Condensate
DQ000920	5	Impinger Solution
DQ000920	6	XAD Module

Radian Run # 07-MM5-BO-03
(Total of 6 train components)

SCC #	Components	Fraction
DQ000921	1	Filter
DQ000921	2	Probe Rinse
DQ000921	3	Back Half/Coil Rinse
DQ000921	4	Condensate
DQ000921	5	Impinger Solution
DQ000921	6	XAD Module

Radian Run # 07-MM5-BI-BL
(Total of 6 train components)

SCC #	Components	Fraction
DQ000917	1	Filter
DQ000917	2	Probe Rinse
DQ000917	3	Back Half/Coil Rinse
DQ000917	4	Condensate
DQ000917	5	Impinger Solution
DQ000917	6	XAD Module

Radian Run # 07-MM5-BO-BL
(Total of 6 train components)

SCC #	Components	Fraction
DQ000913	1	Filter
DQ000913	2	Probe Rinse
DQ000913	3	Back Half/Coil Rinse
DQ000913	4	Condensate
DQ000913	5	Impinger Solution
DQ000913	6	XAD Module

CLEANING PROOF TRAIN

Radian train proof (cleaned unused field sampling glassware train components.) The proof train consists of the following fractions:

SCC #	CONTAINER	FRACTION
DQ000907	1	FILTER
DQ000907	2	PROBE RINSE
DQ000907	3	METHYLENE CHLORIDE RINSE OF PROBE, FILTER HOUSING, COIL, SORBENT MODULE,AND IMPINGERS

REAGENT BLANKS

DQ000928	07-ACETONE-FBL-A	Acetone
DQ000929	07-H20-FBL-A	HPLC Water
DQ000927	07-MeCL-FBL-A	Methylene Chloride

AGHOUSE DUST

SCC #	Sample Type
DQ000912	Baghouse Dust,Run # 1
DQ000916*(2 containers)	Baghouse Dust, Run # 2
DQ000926*(2 containers)	Baghouse Dust, Run # 3

BOILER BOTTOM ASH-PROCESS SAMPLE

SCC #	SAMPLE
DQ000911	Boiler Bottom Ash (Primary Chamber)Run 1
DQ000922	Boiler Bottom Ash (Secondary Chamber)Run 1
DQ000915	Boiler Bottom Ash - Run 2
DQ000924	Boiler Bottom Ash (Primary Chamber) Run 3
DQ000925	Boiler Bottom Ash (Secondary Chamber)Run 3

2. The Priority # 2 samples are wood fuel .These samples should be held by for analysis by TROIKA pending the results of Priority 1 analysis.

SCC #	Sample
DQ000910	Wood Fuel,Run 1
DQ000914	Wood Fuel Run 2
DQ000923	Wood Fuel Run 3

3. The soil sample is the only Priority #3 sample. It will be held by Radian for analysis by Troika pending the results of Priority #1 and Priority #2 sample analyses.

SCC #	Sample
DQ000930	# 07-S-A Soils

If there are any questions concerning this sample shipment, please contact either Winton Kelly or Bob Jongleux at Radian Corporation (919) 481-0212 or (919)-541-9100.

Sincerely,

Robert F Jongleux
TEST TEAM LEADER

cc.E. Hanks-EPA/AMTB ✓
A. Miles-Radian ✓
Radian Field File RTP/PP

April 26, 1985

Dr. Douglas Kuehl
U.S. Environmental Protection Agency
Environmental Research Laboratory
6201 Congdon Blvd.
Duluth, Minnesota 55804

Dear Dr. Kuehl,

Enclosed are the ash samples you requested through William B. Kuykendal, EPA/OAQPS-RTP in the August 16 ,1984 letter to Andrew Miles/Radian Corporation. The ash samples were collected at SITE(S) 07 and 08 of Tier 4 of the National Dioxin Study.

Site 07 is a wood-fired Dutch oven boiler with a multi-cyclone/baghouse emissions control system. Site 07 ash samples were collected at two locations, the baghouse dust hopper and the boiler bottom ash pit. The baghouse dust was collected at the spill point into the dust collection hopper, and the boiler bottom ash was collected as it was raked daily from the ash pit. Both of these materials are ultimately disposed of in a landfill. The samples are composites of samples collected daily during each of three test runs at Site 07. The samples are labeled as follows:

1. SITE 07 BAGHOUSE DUST

   Radian Sample Code:07-BD
   Field # ST-58
   Sample description: Composite Baghouse Dust

2. SITE 07 BOILER BOTTOM ASH

   Radian Sample Code: 07-BBA
   Field # ST-57
   Sample description: Composite Boiler Bottom Ash

Site 08 was a black liquor recovery boiler with a dry bottom electrostatic precipator for particulate emission control. A single Site 08 ash sample was collected from the screw conveyor leading from the electrostatic precipitator .dust collection hopper. This material is commpletely recycled back into the process, except for a small portion that is emitted into the atmosphere from the electrostatic precipitator. There is no other type of ash associated with a black liquor recovery boiler. The sample was collected during the third (final) test run at Site 08. The sample is labeled as follows:

Preceding page blank

3. SITE 08 ELECTROSTATIC PRECIPITATOR CATCH

Radian Sample Code:08-EPC-B
Field # TA-107
Sample description: Electrostatic precipitator catch (salt cake)

The containers for samples from Site 07 and 08 were prepared as detailed in the "National Dioxin Study Tier 4 -Combustion Sources, Quality Assurance Project Plan". This report is an appendix to the site specific test plans for Sites 07 and 08 which will be enclosed under seperate cover to suppy additional information you may require concerning these samples.

If you have any questions concerning this sample shipment, please contact either Andrew Miles or Winton Kelly at Radian Corporation at (919)-541-9100.

Sincerely,
Robert F. Jongleux
Robert F. Jongleux
Test Team Leader

cc.Tier 4 -File
A. Miles
W. Kuykendal-EPA

APPENDIX I

DIOXIN/FURAN ANALYTICAL DATA FOR GASEOUS SAMPLES

TABLE I-1. DIOXIN/FURAN ANALYTICAL DATA FOR MM5 TRAINS (Baghouse Inlet Location)

Isomer/Homologue	Amount Detected, Picograms Per Sample Train[a] Run 01	Run 02	Run 03
Dioxins			
2378-TCDD	--[b]	1,300	1,100
Other TCDD	17,500	30,600	42,750
Penta-CDD	--	35,950	40,300
Hexa-CDD	18,000	35,900	40,850
Hepta-CDD	33,200	28,500	22,900
Octa-CDD	32,100	6,900	6,000
TOTAL PCDD	100,800	139,150	153,900
Furans			
2378-TCDF	--	8,100	8,000
Other TCDF	109,050	152,000	164,450
Penta-CDF	17,200	58,050	58,150
Hexa-CDF	11,900	20,700	23,550
Hepta-CDF	4,800	8,900	7,700
Octa-CDF	ND (11.6)[c]	900	800
TOTAL PCDF	142,950	248,650	262,650

---

[a] See Section 8.3.2 for a discussion of quality assurance/quality control results for these analyses.

[b] Not reported.

[c] Not detected at specified minimum limit of detection.

TABLE I-2. DIOXIN/FURAN ANALYTICAL DATA FOR MM5 TRAINS (Baghouse Outlet Location)

Isomer/Homologue	Amount Detected, Picograms Per Sample Train[a] Run 01	 Run 02	 Run 03
Dioxins			
2378-TCDD	200	300	300
Other TCDD	46,250	70,750	24,250
Penta-CDD	58,900	64,700	19,450
Hexa-CDD	60,550	66,000	19,950
Hepta-CDD	33,000	49,850	30,200
Octa-CDD	9,400	12,600	10,300
TOTAL PCDD	208,300	264,200	104,450
Furans			
2378-TCDF	1,300	2,000	1,800
Other TCDF	32,900	57,400	21,450
Penta-CDF	22,600	33,850	12,900
Hexa-CDF	14,200	22,700	3,500
Hepta-CDF	6,000	10,450	3,200
Octa-CDF	1,200	850	600
TOTAL PCDF	78,200	127,250	43,350

[a] See Section 8.3.2 for a discussion of quality assurance/quality control results for these analyses.

APPENDIX J

RUN-SPECIFIC DIOXIN/FURAN EMISSIONS DATA

J-1 Run-Specific Dioxin/Furan Emissions Data
(As-Measured Concentrations)

J-2 Run-Specific Dioxin/Furan Emissions Data
(Concentrations Corrected to 3 Percent Oxygen)

APPENDIX J-1

Run-Specific Dioxin/Furan Emissions Data (As-Measured Concentrations)

TABLE J-1. DIOXIN/FURAN EMISSIONS DATA FOR RUN 1, SITE WFB-A
(Baghouse Inlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Concentration In Flue Gas (ppt)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	ND (N/A)	ND (N/A)	ND (N/A)
Other TCDD	4.78E+00(N/A)	3.57E-01(N/A)	3.56E+02
Penta-CDD	ND (N/A)	ND (N/A)	ND (N/A)
Hexa-CDD	4.92E+00(N/A)	3.03E-01(N/A)	3.66E+02
Hepta-CDD	9.07E+00(N/A)	5.13E-01(N/A)	6.76E+02
Octa-CDD	8.77E+00(N/A)	4.59E-01(N/A)	6.53E+02
Total PCDD	2.75E+01	1.63E+00	2.05E+03
FURANS			
2378 TCDF	ND (N/A)	ND (N/A)	ND (N/A)
Other TCDF	2.98E+01(N/A)	2.34E+00(N/A)	2.22E+03
Penta-CDF	4.70E+00(N/A)	3.33E-01(N/A)	3.50E+02
Hexa-CDF	3.25E+00(N/A)	2.09E-01(N/A)	2.42E+02
Hepta-CDF	1.31E+00(N/A)	7.71E-02(N/A)	9.77E+01
Octa-CDF	ND (3.17E+00)	ND (1.72E-01)	ND (2.36E+02)
Total PCDF	3.91E+01	2.96E+00	2.91E+03

NOTE: Isomer concentrations shown are at as-measured oxygen conditions.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

TABLE J-2. DIOXIN/FURAN EMISSIONS DATA FOR RUN 2, SITE WFB-A
(Baghouse Inlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Concentration In Flue Gas (ppt)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	3.70E-01(N/A)	2.77E-02(N/A)	2.59E+01
Other TCDD	8.72E+00(N/A)	6.51E-01(N/A)	6.09E+02
Penta-CDD	1.02E+01(N/A)	6.92E-01(N/A)	7.16E+02
Hexa-CDD	1.02E+01(N/A)	6.29E-01(N/A)	7.15E+02
Hepta-CDD	8.12E+00(N/A)	4.60E-01(N/A)	5.68E+02
Octa-CDD	1.97E+00(N/A)	1.03E-01(N/A)	1.37E+02
Total PCDD	3.96E+01	2.56E+00	2.77E+03
FURANS			
2378 TCDF	2.31E+00(N/A)	1.81E-01(N/A)	1.61E+02
Other TCDF	4.33E+01(N/A)	3.40E+00(N/A)	3.03E+03
Penta-CDF	1.65E+01(N/A)	1.17E+00(N/A)	1.16E+03
Hexa-CDF	5.90E+00(N/A)	3.78E-01(N/A)	4.12E+02
Hepta-CDF	2.54E+00(N/A)	1.49E-01(N/A)	1.77E+02
Octa-CDF	2.56E-01(N/A)	1.39E-02(N/A)	1.79E+01
Total PCDF	7.08E+01	5.30E+00	4.95E+03

NOTE: Isomer concentrations shown are at as-measured oxygen conditions.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per-trillion, dry volume basis
8760 operating hours per year

TABLE J-3. DIOXIN/FURAN EMISSIONS DATA FOR RUN 3, SITE WFB-A
(Baghouse Inlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Concentration In Flue Gas (ppt)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	3.18E-01(N/A)	2.38E-02(N/A)	2.21E+01
Other TCDD	1.24E+01(N/A)	9.23E-01(N/A)	8.59E+02
Penta-CDD	1.16E+01(N/A)	7.87E-01(N/A)	8.09E+02
Hexa-CDD	1.18E+01(N/A)	7.26E-01(N/A)	8.21E+02
Hepta-CDD	6.62E+00(N/A)	3.75E-01(N/A)	4.60E+02
Octa-CDD	1.73E+00(N/A)	9.07E-02(N/A)	1.21E+02
Total PCDD	4.45E+01	2.93E+00	3.09E+03
FURANS			
2378 TCDF	2.31E+00(N/A)	1.82E-01(N/A)	1.61E+02
Other TCDF	4.75E+01(N/A)	3.74E+00(N/A)	3.30E+03
Penta-CDF	1.68E+01(N/A)	1.19E+00(N/A)	1.17E+03
Hexa-CDF	6.81E+00(N/A)	4.37E-01(N/A)	4.73E+02
Hepta-CDF	2.23E+00(N/A)	1.31E-01(N/A)	1.55E+02
Octa-CDF	2.31E-01(N/A)	1.25E-02(N/A)	1.61E+01
Total PCDF	7.59E+01	5.69E+00	5.28E+03

NOTE: Isomer concentrations shown are at as-measured oxygen conditions.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

TABLE J-4. DIOXIN/FURAN EMISSIONS DATA FOR RUN 1, SITE WFB-A
(Baghouse Outlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Concentration In Flue Gas (ppt)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	6.01E-02(N/A)	4.49E-03(N/A)	4.48E+00
Other TCDD	1.39E+01(N/A)	1.04E+00(N/A)	1.04E+03
Penta-CDD	1.77E+01(N/A)	1.20E+00(N/A)	1.32E+03
Hexa-CDD	1.82E+01(N/A)	1.12E+00(N/A)	1.36E+03
Hepta-CDD	9.91E+00(N/A)	5.61E-01(N/A)	7.40E+02
Octa-CDD	2.82E+00(N/A)	1.48E-01(N/A)	2.11E+02
Total PCDD	6.26E+01	4.06E+00	4.67E+03
FURANS			
2378 TCDF	3.90E-01(N/A)	3.07E-02(N/A)	2.91E+01
Other TCDF	9.88E+00(N/A)	7.77E-01(N/A)	7.37E+02
Penta-CDF	6.79E+00(N/A)	4.80E-01(N/A)	5.07E+02
Hexa-CDF	4.26E+00(N/A)	2.74E-01(N/A)	3.18E+02
Hepta-CDF	1.80E+00(N/A)	1.06E-01(N/A)	1.34E+02
Octa-CDF	3.60E-01(N/A)	1.95E-02(N/A)	2.69E+01
Total PCDF	2.35E+01	1.69E+00	1.75E+03

NOTE: Isomer concentrations shown are at as-measured oxygen conditions.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

TABLE J-5. DIOXIN/FURAN EMISSIONS DATA FOR RUN 2, SITE WFB-A
(Baghouse Outlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Concentration In Flue Gas (ppt)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	8.80E-02(N/A)	6.57E-03(N/A)	6.38E+00
Other TCDD	2.07E+01(N/A)	1.55E+00(N/A)	1.50E+03
Penta-CDD	1.90E+01(N/A)	1.28E+00(N/A)	1.37E+03
Hexa-CDD	1.94E+01(N/A)	1.19E+00(N/A)	1.40E+03
Hepta-CDD	1.46E+01(N/A)	8.27E-01(N/A)	1.06E+03
Octa-CDD	3.70E+00(N/A)	1.93E-01(N/A)	2.68E+02
Total PCDD	7.75E+01	5.05E+00	5.61E+03
FURANS			
2378 TCDF	5.87E-01(N/A)	4.61E-02(N/A)	4.25E+01
Other TCDF	1.68E+01(N/A)	1.32E+00(N/A)	1.22E+03
Penta-CDF	9.93E+00(N/A)	7.02E-01(N/A)	7.19E+02
Hexa-CDF	6.66E+00(N/A)	4.27E-01(N/A)	4.82E+02
Hepta-CDF	3.06E+00(N/A)	1.80E-01(N/A)	2.22E+02
Octa-CDF	2.49E-01(N/A)	1.35E-02(N/A)	1.81E+01
Total PCDF	3.73E+01	2.69E+00	2.70E+03

NOTE: Isomer concentrations shown are at as-measured oxygen conditions.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

TABLE J-6. DIOXIN/FURAN EMISSIONS DATA FOR RUN 3, SITE WFB-A (Baghouse Outlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Concentration In Flue Gas (ppt)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	9.38E-02(N/A)	7.00E-03(N/A)	6.60E+00
Other TCDD	7.58E+00(N/A)	5.66E-01(N/A)	5.34E+02
Penta-CDD	6.08E+00(N/A)	4.11E-01(N/A)	4.28E+02
Hexa-CDD	6.23E+00(N/A)	3.84E-01(N/A)	4.39E+02
Hepta-CDD	9.44E+00(N/A)	5.34E-01(N/A)	6.64E+02
Octa-CDD	3.22E+00(N/A)	1.68E-01(N/A)	2.27E+02
Total PCDD	3.26E+01	2.07E+00	2.30E+03
FURANS			
2378 TCDF	5.63E-01(N/A)	4.42E-02(N/A)	3.96E+01
Other TCDF	6.70E+00(N/A)	5.27E-01(N/A)	4.72E+02
Penta-CDF	4.00E+00(N/A)	2.83E-01(N/A)	2.82E+02
Hexa-CDF	1.09E+00(N/A)	7.02E-02(N/A)	7.70E+01
Hepta-CDF	1.00E+00(N/A)	5.88E-02(N/A)	7.04E+01
Octa-CDF	1.88E-01(N/A)	1.02E-02(N/A)	1.32E+01
Total PCDF	1.35E+01	9.93E-01	9.54E+02

NOTE: Isomer concentrations shown are at as-measured oxygen conditions.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

APPENDIX J-2

Run-Specific Dioxin/Furan Emissions Data
(Concentrations Corrected to 3 Percent Oxygen)

TABLE J-7. DIOXIN/FURAN EMISSIONS DATA FOR RUN 1, SITE WFB-A (Baghouse Inlet Location, Concentrations Corrected to 3% Oxygen)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm @ 3% oxygen)	Isomer Concentration In Flue Gas (ppt @ 3% oxygen)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	ND (N/A)	ND (N/A)	ND (N/A)
Other TCDD	1.12E+01(N/A)	8.35E-01(N/A)	3.56E+02
Penta-CDD	ND (N/A)	ND (N/A)	ND (N/A)
Hexa-CDD	1.15E+01(N/A)	7.07E-01(N/A)	3.66E+02
Hepta-CDD	2.12E+01(N/A)	1.20E+00(N/A)	6.76E+02
Octa-CDD	2.05E+01(N/A)	1.07E+00(N/A)	6.53E+02
Total PCDD	6.44E+01	3.81E+00	2.05E+03
FURANS			
2378 TCDF	ND (N/A)	ND (N/A)	ND (N/A)
Other TCDF	6.97E+01(N/A)	5.48E+00(N/A)	2.22E+03
Penta-CDF	1.10E+01(N/A)	7.77E-01(N/A)	3.50E+02
Hexa-CDF	7.60E+00(N/A)	4.88E-01(N/A)	2.42E+02
Hepta-CDF	3.07E+00(N/A)	1.80E-01(N/A)	9.77E+01
Octa-CDF	ND (7.41E+00)	ND (4.01E-01)	ND (2.36E+02)
Total PCDF	9.13E+01	6.92E+00	2.91E+03

NOTE: Isomer concentrations shown are corrected to 3% oxygen.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

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TABLE J-8. DIOXIN/FURAN EMISSIONS DATA FOR RUN 2, SITE WFB-A (Baghouse Inlet Location, Concentrations Corrected to 3% Oxygen)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm @ 3% oxygen)	Isomer Concentration In Flue Gas (ppt @ 3% oxygen)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	**9.39E-01(N/A)**	**7.01E-02(N/A)**	**2.59E+01**
Other TCDD	2.21E+01(N/A)	1.65E+00(N/A)	6.09E+02
Penta-CDD	2.60E+01(N/A)	1.75E+00(N/A)	7.16E+02
Hexa-CDD	2.59E+01(N/A)	1.60E+00(N/A)	7.15E+02
Hepta-CDD	2.06E+01(N/A)	1.17E+00(N/A)	5.68E+02
Octa-CDD	4.98E+00(N/A)	2.61E-01(N/A)	1.37E+02
Total PCDD	1.01E+02	6.50E+00	2.77E+03
FURANS			
2378 TCDF	5.85E+00(N/A)	4.60E-01(N/A)	1.61E+02
Other TCDF	1.10E+02(N/A)	8.63E+00(N/A)	3.03E+03
Penta-CDF	4.19E+01(N/A)	2.97E+00(N/A)	1.16E+03
Hexa-CDF	1.50E+01(N/A)	9.59E-01(N/A)	4.12E+02
Hepta-CDF	6.43E+00(N/A)	3.78E-01(N/A)	1.77E+02
Octa-CDF	6.50E-01(N/A)	3.52E-02(N/A)	1.79E+01
Total PCDF	1.80E+02	1.34E+01	4.95E+03

NOTE: Isomer concentrations shown are corrected to 3% oxygen.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

TABLE J-9. DIOXIN/FURAN EMISSIONS DATA FOR RUN 3, SITE WFB-A (Baghouse Inlet Location, Concentrations Corrected to 3% Oxygen)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm @ 3% oxygen)	Isomer Concentration In Flue Gas (ppt @ 3% oxygen)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	8.06E-01(N/A)	6.02E-02(N/A)	2.21E+01
Other TCDD	3.13E+01(N/A)	2.34E+00(N/A)	8.59E+02
Penta-CDD	2.95E+01(N/A)	2.00E+00(N/A)	8.09E+02
Hexa-CDD	2.99E+01(N/A)	1.84E+00(N/A)	8.21E+02
Hepta-CDD	1.68E+01(N/A)	9.50E-01(N/A)	4.60E+02
Octa-CDD	4.40E+00(N/A)	2.30E-01(N/A)	1.21E+02
Total PCDD	1.13E+02	7.42E+00	3.09E+03
FURANS			
2378 TCDF	5.86E+00(N/A)	4.61E-01(N/A)	1.61E+02
Other TCDF	1.20E+02(N/A)	9.47E+00(N/A)	3.30E+03
Penta-CDF	4.26E+01(N/A)	3.01E+00(N/A)	1.17E+03
Hexa-CDF	1.73E+01(N/A)	1.11E+00(N/A)	4.73E+02
Hepta-CDF	5.64E+00(N/A)	3.32E-01(N/A)	1.55E+02
Octa-CDF	5.86E-01(N/A)	3.18E-02(N/A)	1.61E+01
Total PCDF	1.92E+02	1.44E+01	5.28E+03

NOTE: Isomer concentrations shown are corrected to 3% oxygen.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

TABLE J-10. DIOXIN/FURAN EMISSIONS DATA FOR RUN 1, SITE WFB-A CONCENTRATIONS CORRECTED TO 3% OXYGEN (Baghouse Outlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm @ 3% oxygen)	Isomer Concentration In Flue Gas (ppt @ 3% oxygen)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	2.12E-01(N/A)	1.58E-02(N/A)	4.48E+00
Other TCDD	4.90E+01(N/A)	3.66E+00(N/A)	1.04E+03
Penta-CDD	6.24E+01(N/A)	4.22E+00(N/A)	1.32E+03
Hexa-CDD	6.42E+01(N/A)	3.95E+00(N/A)	1.36E+03
Hepta-CDD	3.50E+01(N/A)	1.98E+00(N/A)	7.40E+02
Octa-CDD	9.96E+00(N/A)	5.21E-01(N/A)	2.11E+02
Total PCDD	2.21E+02	1.43E+01	4.67E+03
FURANS			
2378 TCDF	1.38E+00(N/A)	1.08E-01(N/A)	2.91E+01
Other TCDF	3.49E+01(N/A)	2.74E+00(N/A)	7.37E+02
Penta-CDF	2.40E+01(N/A)	1.69E+00(N/A)	5.07E+02
Hexa-CDF	1.51E+01(N/A)	9.65E-01(N/A)	3.18E+02
Hepta-CDF	6.36E+00(N/A)	3.74E-01(N/A)	1.34E+02
Octa-CDF	1.27E+00(N/A)	6.89E-02(N/A)	2.69E+01
Total PCDF	8.29E+01	5.95E+00	1.75E+03

NOTE: Isomer concentrations shown are corrected to 3% oxygen.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

TABLE J-11. DIOXIN/FURAN EMISSIONS DATA FOR RUN 2, SITE WFB-A CONCENTRATIONS CORRECTED TO 3% OXYGEN (Baghouse Outlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm @ 3% oxygen)	Isomer Concentration In Flue Gas (ppt @ 3% oxygen)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	2.73E-01(N/A)	2.04E-02(N/A)	6.38E+00
Other TCDD	6.44E+01(N/A)	4.81E+00(N/A)	1.50E+03
Penta-CDD	5.89E+01(N/A)	3.98E+00(N/A)	1.37E+03
Hexa-CDD	6.01E+01(N/A)	3.70E+00(N/A)	1.40E+03
Hepta-CDD	4.54E+01(N/A)	2.57E+00(N/A)	1.06E+03
Octa-CDD	1.15E+01(N/A)	6.00E-01(N/A)	2.68E+02
Total PCDD	2.40E+02	1.57E+01	5.61E+03
FURANS			
2378 TCDF	1.82E+00(N/A)	1.43E-01(N/A)	4.25E+01
Other TCDF	5.22E+01(N/A)	4.11E+00(N/A)	1.22E+03
Penta-CDF	3.08E+01(N/A)	2.18E+00(N/A)	7.19E+02
Hexa-CDF	2.07E+01(N/A)	1.33E+00(N/A)	4.82E+02
Hepta-CDF	9.51E+00(N/A)	5.59E-01(N/A)	2.22E+02
Octa-CDF	7.74E-01(N/A)	4.19E-02(N/A)	1.81E+01
Total PCDF	1.16E+02	8.36E+00	2.70E+03

NOTE: Isomer concentrations shown are corrected to 3% oxygen.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

TABLE J-12. DIOXIN/FURAN EMISSIONS DATA FOR RUN 3, SITE WFB-A CONCENTRATIONS CORRECTED TO 3% OXYGEN (Baghouse Outlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm @ 3% oxygen)	Isomer Concentration In Flue Gas (ppt @ 3% oxygen)	Isomer Hourly Emissions Rate (ug/hr)
DIOXINS			
2378 TCDD	3.52E-01(N/A)	2.63E-02(N/A)	6.60E+00
Other TCDD	2.84E+01(N/A)	2.12E+00(N/A)	5.34E+02
Penta-CDD	2.28E+01(N/A)	1.54E+00(N/A)	4.28E+02
Hexa-CDD	2.34E+01(N/A)	1.44E+00(N/A)	4.39E+02
Hepta-CDD	3.54E+01(N/A)	2.00E+00(N/A)	6.64E+02
Octa-CDD	1.21E+01(N/A)	6.31E-01(N/A)	2.27E+02
Total PCDD	1.22E+02	7.76E+00	2.30E+03
FURANS			
2378 TCDF	2.11E+00(N/A)	1.66E-01(N/A)	3.96E+01
Other TCDF	2.51E+01(N/A)	1.98E+00(N/A)	4.72E+02
Penta-CDF	1.50E+01(N/A)	1.06E+00(N/A)	2.82E+02
Hexa-CDF	4.10E+00(N/A)	2.63E-01(N/A)	7.70E+01
Hepta-CDF	3.75E+00(N/A)	2.21E-01(N/A)	7.04E+01
Octa-CDF	7.03E-01(N/A)	3.81E-02(N/A)	1.32E+01
Total PCDF	5.08E+01	3.72E+00	9.54E+02

NOTE: Isomer concentrations shown are corrected to 3% oxygen.

ND = not detected (detection limit in parentheses).
N/A = Not applicable when the values are positive. QA samples indicate the method capabilities and minimum limits of detection.
ng = 1.0E-09g
ug = 1.0E-06g
ppt = parts per trillion, dry volume basis
8760 operating hours per year

APPENDIX K

RUN-SPECIFIC RISK MODELING INPUT DATA

TABLE K-1. RISK MODELING PARAMETERS FOR RUN 1, SITE WFB-A
(Baghouse Inlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Hourly Emissions Rate (ug/hr)	Relative Potency Factor	2,3,7,8 - TCDD Equivalent Emissions (mg/yr)
2378 TCDD	ND (N/A)	ND (N/A)	1.000	ND (N/A)
Other TCDD	4.78E+00	3.56E+02	.010	3.12E+01
2378 TCDF	ND (N/A)	ND (N/A)	.100	ND (N/A)
Other TCDF	2.98E+01	2.22E+03	.001	1.94E+01
Penta-CDD	ND (N/A)	ND (N/A)	.500	ND (N/A)
Penta-CDF	4.70E+00	3.50E+02	.100	3.07E+02
Hexa-CDD	4.92E+00	3.66E+02	.040	1.28E+02
Hexa-CDF	3.25E+00	2.42E+02	.010	2.12E+01
Hepta-CDD	9.07E+00	6.76E+02	.001	5.92E+00
Hepta-CDF	1.31E+00	9.77E+01	.001	8.56E-01
Octa-CDD	8.77E+00	6.53E+02	.000	.00E+00
Octa-CDF	ND (3.17E+00)	ND (2.36E+02)	.000	ND (.00E+00)
Net 2378 TCDD Equivalent Atmospheric Loading				5.14E+02

ND = not detected (detection limit in parentheses).
N/A = detection limit not available
ng = 1.0E-09g
ug = 1.0E-06g
mg = 1.0E-03g
Standard conditions: 293 K (20 C) temperature and 1 atmosphere pressure.
8760 operating hours per year

TABLE K-2. RISK MODELING PARAMETERS FOR RUN 2, SITE WFB-A (Baghouse Inlet location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Hourly Emissions Rate (ug/hr)	Relative Potency Factor	2,3,7,8 - TCDD Equivalent Emissions (mg/yr)
2378 TCDD	3.70E-01	2.59E+01	1.000	2.27E+02
Other TCDD	8.72E+00	6.09E+02	.010	5.34E+01
2378 TCDF	2.31E+00	1.61E+02	.100	1.41E+02
Other TCDF	4.33E+01	3.03E+03	.001	2.65E+01
Penta-CDD	1.02E+01	7.16E+02	.500	3.14E+03
Penta-CDF	1.65E+01	1.16E+03	.100	1.01E+03
Hexa-CDD	1.02E+01	7.15E+02	.040	2.51E+02
Hexa-CDF	5.90E+00	4.12E+02	.010	3.61E+01
Hepta-CDD	8.12E+00	5.68E+02	.001	4.97E+00
Hepta-CDF	2.54E+00	1.77E+02	.001	1.55E+00
Octa-CDD	1.97E+00	1.37E+02	.000	.00E+00
Octa-CDF	2.56E-01	1.79E+01	.000	.00E+00
Net 2378 TCDD Equivalent Atmospheric Loading				4.89E+03

ND = not detected (detection limit in parentheses).
N/A = detection limit not available
ng = 1.0E-09g
ug = 1.0E-06g
mg = 1.0E-03g
Standard conditions: 293 K (20 C) temperature and 1 atmosphere pressure.
8760 operating hours per year

TABLE K-3. RISK MODELING PARAMETERS FOR RUN 3, SITE WFB-A (Baghouse Inlet Location)

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Hourly Emissions Rate (ug/hr)	Relative Potency Factor	2,3,7,8 - TCDD Equivalent Emissions (mg/yr)
2378 TCDD	3.18E-01	2.21E+01	1.000	1.94E+02
Other TCDD	1.24E+01	8.59E+02	.010	7.52E+01
2378 TCDF	2.31E+00	1.61E+02	.100	1.41E+02
Other TCDF	4.75E+01	3.30E+03	.001	2.89E+01
Penta-CDD	1.16E+01	8.09E+02	.500	3.55E+03
Penta-CDF	1.68E+01	1.17E+03	.100	1.02E+03
Hexa-CDD	1.18E+01	8.21E+02	.040	2.88E+02
Hexa-CDF	6.81E+00	4.73E+02	.010	4.14E+01
Hepta-CDD	6.62E+00	4.60E+02	.001	4.03E+00
Hepta-CDF	2.23E+00	1.55E+02	.001	1.35E+00
Octa-CDD	1.73E+00	1.21E+02	.000	.00E+00
Octa-CDF	2.31E-01	1.61E+01	.000	.00E+00
Net 2378 TCDD Equivalent Atmospheric Loading				5.34E+03

ND = not detected (detection limit in parentheses).
N/A = detection limit not available
ng = 1.0E-09g
ug = 1.0E-06g
mg = 1.0E-03g
Standard conditions: 293 K (20 C) temperature and 1 atmosphere pressure.
8760 operating hours per year

TABLE K-4. RISK MODELING PARAMETERS FOR RUN 1, SITE WFB-A (Baghouse Outlet Location)

Latitude = 47 12 26
Longitude = 123 05 47
Stack Height (From Grade Level) = 38.1 m
Stack Diameter (ID) = 3.1 m
Flue Gas Flow Rate (Dry Standard) = 1244.13 dscmm
Flue Gas Exit Temperature = 491.0 K
Flue Gas Exit Velocity (Actual) = 337.3 mpm

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Hourly Emissions Rate (ug/hr)	Relative Potency Factor	2,3,7,8 - TCDD Equivalent Emissions (mg/yr)
2378 TCDD	6.01E-02	4.48E+00	1.000	3.93E+01
Other TCDD	1.39E+01	1.04E+03	.010	9.08E+01
2378 TCDF	3.90E-01	2.91E+01	.100	2.55E+01
Other TCDF	9.88E+00	7.37E+02	.001	6.46E+00
Penta-CDD	1.77E+01	1.32E+03	.500	5.78E+03
Penta-CDF	6.79E+00	5.07E+02	.100	4.44E+02
Hexa-CDD	1.82E+01	1.36E+03	.040	4.76E+02
Hexa-CDF	4.26E+00	3.18E+02	.010	2.79E+01
Hepta-CDD	9.91E+00	7.40E+02	.001	6.48E+00
Hepta-CDF	1.80E+00	1.34E+02	.001	1.18E+00
Octa-CDD	2.82E+00	2.11E+02	.000	.00E+00
Octa-CDF	3.60E-01	2.69E+01	.000	.00E+00
Net 2378 TCDD Equivalent Atmospheric Loading				6.90E+03

ND = not detected (detection limit in parentheses).
N/A = detection limit not available
ng = 1.0E-09g
ug = 1.0E-06g
mg = 1.0E-03g
Standard conditions: 293 K (20 C) temperature and 1 atmosphere pressure.
8760 operating hours per year

TABLE K-5. RISK MODELING PARAMETERS FOR RUN 2, SITE WFB-A
(Baghouse Outlet Location)

Latitude = 47 12 26
Longitude = 123 05 47
Stack Height (From Grade Level) = 38.1 m
Stack Diameter (ID) = 3.1 m
Flue Gas Flow Rate (Dry Standard) = 1207.83 dscmm
Flue Gas Exit Temperature = 503.0 K
Flue Gas Exit Velocity (Actual) = 340.0 mpm

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Hourly Emissions Rate (ug/hr)	Relative Potency Factor	2,3,7,8 - TCDD Equivalent Emissions (mg/yr)
2378 TCDD	8.80E-02	6.38E+00	1.000	5.58E+01
Other TCDD	2.07E+01	1.50E+03	.010	1.32E+02
2378 TCDF	5.87E-01	4.25E+01	.100	3.72E+01
Other TCDF	1.68E+01	1.22E+03	.001	1.07E+01
Penta-CDD	1.90E+01	1.37E+03	.500	6.02E+03
Penta-CDF	9.93E+00	7.19E+02	.100	6.30E+02
Hexa-CDD	1.94E+01	1.40E+03	.040	4.91E+02
Hexa-CDF	6.66E+00	4.82E+02	.010	4.23E+01
Hepta-CDD	1.46E+01	1.06E+03	.001	9.28E+00
Hepta-CDF	3.06E+00	2.22E+02	.001	1.95E+00
Octa-CDD	3.70E+00	2.68E+02	.000	.00E+00
Octa-CDF	2.49E-01	1.81E+01	.000	.00E+00
Net 2378 TCDD Equivalent Atmospheric Loading				7.43E+03

ND = not detected (detection limit in parentheses).
N/A = detection limit not available
ng = 1.0E-09g
ug = 1.0E-06g
mg = 1.0E-03g
Standard conditions: 293 K (20 C) temperature and 1 atmosphere pressure.
8760 operating hours per year

TABLE K-6. RISK MODELING PARAMETERS FOR RUN 3, SITE WFB-A
(Baghouse Outlet Location)

Latitude = 47 12 26
Longitude = 123 05 47
Stack Height (From Grade Level) = 38.1 m
Stack Diameter (ID) = 3.1 m
Flue Gas Flow Rate (Dry Standard) = 1173.39 dscmm
Flue Gas Exit Temperature = 497.1 K
Flue Gas Exit Velocity (Actual) = 312.6 mpm

Dioxin/Furan Isomer	Isomer Concentration In Flue Gas (ng/dscm)	Isomer Hourly Emissions Rate (ug/hr)	Relative Potency Factor	2,3,7,8 - TCDD Equivalent Emissions (mg/yr)
2378 TCDD	9.38E-02	6.60E+00	1.000	5.78E+01
Other TCDD	7.58E+00	5.34E+02	.010	4.67E+01
2378 TCDF	5.63E-01	3.96E+01	.100	3.47E+01
Other TCDF	6.70E+00	4.72E+02	.001	4.13E+00
Penta-CDD	6.08E+00	4.28E+02	.500	1.87E+03
Penta-CDF	4.00E+00	2.82E+02	.100	2.47E+02
Hexa-CDD	6.23E+00	4.39E+02	.040	1.54E+02
Hexa-CDF	1.09E+00	7.70E+01	.010	6.75E+00
Hepta-CDD	9.44E+00	6.64E+02	.001	5.82E+00
Hepta-CDF	1.00E+00	7.04E+01	.001	6.17E-01
Octa-CDD	3.22E+00	2.27E+02	.000	.00E+00
Octa-CDF	1.88E-01	1.32E+01	.000	.00E+00
Net 2378 TCDD Equivalent Atmospheric Loading				2.43E+03

ND = not detected (detection limit in parentheses).
N/A = detection limit not available
ng = 1.0E-09g
ug = 1.0E-06g
mg = 1.0E-03g
Standard conditions: 293 K (20 C) temperature and 1 atmosphere pressure.
8760 operating hours per year

APPENDIX L

COMPOUND-SPECIFIC PRECURSOR RESULTS

TABLE L-1. COMPOUND-SPECIFIC DIOXIN PRECURSOR DATA FOR SITE WFB-A FEED SAMPLES

Precursor Compounds	Precursor Concentration, ug/g (ppm)			
	Wood Feed Samples			
	Run 1	Run 2	Run 3	Average
Base Neutrals Fraction				
Chlorinated Benzenes:				
Dichlorobenzenes				
Trichlorobenzenes				
Tetrachlorobenzenes				
Pentachlorobenzenes				
Hexachlorobenzenes				
Total Chlorinated Benzenes	0	0, 0	0, 0	0
Chlorinated Biphenyls:				
Chlorobiphenyls				
Dichlorobiphenyls				
Trichlorobiphenyls				
Tetrachlorobiphenyls				
Pentachlorobiphenyls				
Hexachlorobiphenyls				
Heptachlorobiphenyls				
Octachlorobiphenyls				
Nonachlorobiphenyls				
Decachlorobiphenyls				
Total Chlorinated Biphenyls	0	0, 0	0, 0	0
Acids Fraction				
Chlorinated Phenols:				
Dichlorophenols				
Trichlorophenols				
Tetrachloropheols				
Pentachlorophenols				
Total Chlorinated Phenols	0	0, 0	0	0